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## Monterey, California



# THESIS

THE DEVELOPMENT OF SELECTION STANDARDS  
FOR THREE NAVY RATINGS WHICH VARY  
IN LEVEL OF COMPLEXITY

by

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June 1983

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The Development of Selection Standards  
for Three Navy Ratings which Vary  
in Level of Complexity

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from the

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## ABSTRACT

This thesis is concerned with selection standards for three US Navy ratings which vary in terms of their complexity. The relevant literature is reviewed and a general selection standards approach is developed. This approach is then applied to subsamples of a large US Navy cohort of enlistees who all had the opportunity of serving for at least four years. Within each rating, prediction equations are developed which link various data available prior to the beginning of the enlistee's service with three criterion measures of performance. Analyses are performed separately for groupings within ratings by race and sex. Utility analysis is employed to help determine optimum cut-offs on predictors. Many potentially useful predictive relationships are found and amongst the results is the finding that for some ratings, ability subtests are negatively related to criteria of performance. Other results are discussed and recommendations regarding implementation and future research are made.



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## I. INTRODUCTION

The Armed Forces in many countries have been ardent users of the psychological techniques of selection and classification. The Forces' involvement with these procedures has been for such a considerable period of time that, in fact, it could be argued that the development and refinement of these techniques has been greatly enhanced by the manpower demands of the military. In war, and in preparation for war (i.e. mobilization), the military required techniques which allowed the assessment of the training capabilities of prospective civilians for their rapid transition from civilian to uniformed status. It was inefficient to have every potential enlistee embark on a course of training when psychometric tests could be used to exclude those individuals with the lowest chances of success. Since the Second World War, the peace time forces, largely through the development of more complex weapons systems, have come to demand much more specialized manpower skills. The Forces' requirement for selection and classification, therefore, has not only involved making military personnel out of civilians (i.e. selection), but also dealt with the correct placement of enlistees by military occupation (i.e. classification). Both the size and the diversity of the Armed Forces' manpower requirements have made it a very fertile testing ground for the application of these psychological procedures.

The present thesis is concerned with the refinement of selection standards for three employment categories (ratings) in the United States Navy. The three ratings have been chosen on the basis of the complexity of the tasks in the ratings. In increasing order of complexity they are:



Ship's Serviceman, Personnelman and Aviation Technician. All three ratings have currently applied test score entry standards based on the Armed Services Vocational Aptitude Battery (ASVAB). The aim is to examine the possibility of improving the selection criteria for each rating, taking into account rating specific utilities of correct and incorrect selection decisions. At the same time, the selection standards across jobs will be compared. Such an inter-job analysis will illustrate the relationship, if any, that job complexity has with the selection standards. This latter analysis will be qualitative (what kinds of predictors are more suited to what type of job) and quantitative (how does the level of accuracy of selection vary with job complexity).

Selection standards research for the US Navy is important for a large number of reasons. From the point of view of manpower planning, better selection standards may mean smaller training attrition, better job performance, longer careers and more rapid promotion. These outcomes have the effect of lifting the burden of maintaining the Navy's end strength from new enlistments by having greater numbers in the career force. This has even more significance with the projected decline in the services' traditional manpower pool over the next decade, particularly in that when manpower resources are scarcer, the disutility of rejecting potentially successful applicants is much greater than it is in the current recruiting climate. In a broader context, current government regulation explicitly forbids selection practices which may have adverse impacts on minority or other groups in the community (Uniform Guidelines on Employee Selection Procedures, 1978) without first investigating the use of "alternative selection procedures that are equally valid, but that produce less adverse impact" (Reilly and Chao, 1982). It is incumbent upon all employers, including the US Navy, first to determine the validity of



their current procedures and then to examine the possibility of using alternative methods which may either improve on these standards or are equally valid standards which have less adverse impact. Thus there is a strong extrinsically initiated incentive for an organization to be interested in, and to be able to measure the validity of, its own selection procedures.

There is a wealth of research on selection standards both in the US Navy and in many other employment settings. Given the aim of looking at selection, in relation to the complexity of the job and the validity of the procedures, the next chapter is devoted to literature surveys. The first section deals with the theoretical aspects of selection research, while the second is a review of the findings of previous research regarding those factors which seem most predictive of job success, in general, and for the services in particular.

The third chapter brings the information of the previous one together so as to make a clear statement of the purpose, aim, design and expected outcome of the research.

Chapter four deals with the method. First, the subject ratings are described. This includes a description of each rating, the standards currently applied and an examination of the paths through which individuals enter the ratings. It will include the complexity grading of each rating. Next comes a description of the data base for this research: where it comes from, what is included and an assessment of the quality of the data. In the next section, the personnel are described. This is followed by a section which concerns the criterion measures and predictors: What are they?, and, How they are measured? Another section describes the estimates of the utility of correct predictions and the disutilities associated with misclassifications. Next, the cross-validation procedures used for the estimation of the



validity coefficient are described. Finally, the statistical techniques are discussed.

Chapter five concerns results. The first section deals with descriptive statistics for each of the three ratings, which includes age distributions, racial and sex mixes as well as prior education levels. The next section concerns the results from using regression techniques. The final section presents results in which the direct effects of selection cut-offs are examined with respect to maximising total expected return for the selected procedure.

Chapter six is for the discussion of the results. It is divided into two sections: expected outcomes and other findings. Particular attention is paid to across rating comparisons.

Chapter seven provides a summary and a statement of the conclusions and recommendations.





## II. LITERATURE REVIEW

The purpose of this chapter is to review some of the literature relevant to selection standards research. The first section deals with a general overview of the technical and psychological aspects: How should selection standards be established? What is the concept of validity and how does it apply? What types of experimental design are possible and appropriate in this type of research? Then, in more detail specific theoretical issues are addressed. These are job analysis, criterion selection, predictor selection, validation and cross validation. The second section reviews research conducted specifically in selection and/or attrition. These questions are addressed: What variables have been found to be predictive of success in the work environment? Specifically, what variables are associated with success in a service environment? And finally, what factors predict success in a Navy environment? The final section provides a summary of the theory of, and the previous research in, selection.

### A. THEORETICAL LITERATURE

#### 1. Classical Model

A classical model for establishing selection standards is suggested by Drenth (1971). Like most classical approaches it is probably never rigidly applied, however Drenth's suggestion gives a good description of the steps involved and is a useful starting point for this section. These steps are summarised in Table I.



TABLE I  
Classical Model of Selection

Step 1.	Job Analysis
Step 2.	Choice of a Criterion
Step 3.	Try-out Series of Tests
Step 4.	Testing of Experimental Group
Step 5.	Validation of Tests
Step 6.	Cross Validation
Step 7.	Tests in Final Form

Source: Drenth, P "Theory and Methods  
of Selection", 1971.

The first task is a job analysis in order that the psychological requirements of the job can be understood. In this step it is necessary to convert the description of the job into specific factors or variables which are defined and, hopefully, are measurable. The second task is to determine the criterion which is the operational means of measuring an employee's job performance. A knowledge of the criterion value should permit a ready differentiation of the good performers from the poorer ones. Ideally, it will be a metric or ordinal scale which will indicate ranges or grades of performance. In the third step, the job analysis is used to make an 'educated' guess as to what kinds of tests or other factors are important for predicting success in the job for which the standards are designed. The preceding steps are necessary precursors to the next group which deal with the empirical portion of the process. The fourth step consists of the try-out (or pilot) tests which are administered to a representative sample of the population for which the standards are to be developed. Scores or results are recorded and retained while the employees are given a period



of time to perform on-the-job. In step five, these subjects are measured on the performance criteria developed in step two, and the results are correlated with the test scores gathered in the previous step. From this analysis the merit of each test is determined leading to the a choice of tests most useful for selection and their appropriate cut off scores. Step six is critical: the cross validation of the selection standards for new group of subjects. In this step the same procedure as applied in steps three to five is repeated using the chosen selection tests. Step seven is largely administrative. The selection tests are set up in a standard form. For small organisations this step may not be essential, but for larger ones the standardization of the tests is highly desirable, especially where there may be several different testing stations.

The Drenth classical model is a very simplistic scheme of the procedure for establishing selection standards. For one thing, it appears to assume that the organization has no selection procedures in existence, simply allowing individuals to drift into occupations. While it may not be strictly formalised, the organization probably has a good notion of what is required in the job and applies this information as a screening device. Despite these limitations, the model alludes to some very important issues which are discussed in the subsequent paragraphs.

## 2. Validity and Research Design

Validity is a very important issue. In the simple case above, it is described as some means of comparing the selection test results with subsequent performance in order to validate selection standards. Validity answers the question: do these test scores tell us a sufficient amount about the individuals' subsequent performance so that, based only on a knowledge of their selection test results, one is able



to choose the better performers. Statistically, it is usually represented by a correlation coefficient which expresses the degree of association between the selection test scores and the measure of subsequent performance.

Two main types of research designs have been defined with respect to selection validation. These are predictive and concurrent validity (see Tiffin and McCormack, 1970). Predictive validity is that implied in the model above: selection tests are given to a group of applicants and then at some later date, criterion measures of performance are made. The test scores and criterion measures are then compared. For concurrent validity design, the tests scores and criterion measures are gathered virtually at the same time. For both types, the tests, or a subset of the tests, are considered valid, if the correlations are large enough. Until recently, the predictive validity design was considered far superior than concurrent validity approach (Drenth, 1971). However Barrett et al (1981) persuasively argue that the evidence does not support this position. They suggest that a large number of independent studies, including a recent meta analysis of 537 separate studies, have indicated virtually no difference between the magnitude of the validities found for concurrent and predictive designs. They also cite one researcher who specifically compared the two designs in a national validation of selection procedures for male transit bus drivers and found that the validity coefficients were comparable. These arguments are convincing but what are the significant differences between the two validation designs?

Guion and Cranny (1982) suggest that the key difference is that for predictive designs there is a lapse of time between test and criterion measurement whereas in concurrent designs the measurements are made simultaneously. However, there is a second fundamental difference between the two:







predictive designs invariably test groups of applicants, rather than employees, as tested in concurrent designs. There are some problems for concurrent designs in relation to the restriction of range of tests scores. The employees who are the subject of concurrent designs have been preselected contributing to a narrowing of the range of data. As is noted by Hammer and Landau (1981, p. 576), range restriction shrinks the feasible range of the correlation coefficient; that is, its feasible maximum value becomes less than one. Predictive designs are not completely free from correlation problems, since there is a time difference between tests and criteria. Scores on the latter may well be due to factors other than those implied by the tests scores. Intervening variables (e.g. training factors, motivational changes) could also inhibit criterion performances. Additionally, attrition may reduce the size of the group so that there are fewer individuals available for criterion measurement than were originally tested. It can be seen that both concurrent and predictive designs are susceptible to shrinkage of validity coefficients.

While it seems only logical for an organization, particularly a large one, to have valid selection procedures, government regulation has a significant impact on these procedures requiring employers to have selection systems which have been tested through a general validity model. Hsu (1982) points out that the Uniform Guidelines on Employee Selection Procedures (1978) specify "that a necessary condition for use of a selection procedure, when that procedure produces adverse impacts on the hiring rates of certain minority groups, is that this procedure be demonstrated valid" (Hsu 1982, p. 509), but that this is not a sufficient condition for its use. Hsu explains that for an organisation to use any existing selection procedure that produces adverse minority impacts, it must have higher



validity than alternatives which have no adverse impacts. Many civil actions have been won during the last decade by employees (see Rowland et al, 1980, pp. 64-85) against employers who have had selection systems for which the validity has been unknown or inadequately established. So there is a considerable amount of external pressure for the organization to, first, know what the validity of its procedure is, and to, second, establish, in the case that there are adverse impacts, that there is no alternative system which is equally valid that will produce a less adverse impact.

Given this general overview of the technical literature, it is now possible to deal in more detail with other issues.

### 3. Job Analysis

It is probably a fairly safe assumption that very few attempts at introducing selection standards begin with a thorough job analysis (such as is described in Dunnette, 1976, Chapter 15). This is so for a variety of reasons, not the least of which is that it is very time consuming and requires a considerable amount of effort with, at best, very little by way of quickly identifiable return for these labours. A job analysis is not part of this research, but Chapter IV includes a brief job description of the three Navy ratings involved, in order to put them into an appropriate context. Presumably thorough job analyses have been done for these ratings and used for the development of the selection procedures.

### 4. Criterion Selection

Dunnette's book ("The Handbook of Industrial and Organizational Psychology", 1976) has two excellent chapters on the selection of an appropriate criterion, which is the



second step in Table I. This is perhaps the hardest step of all and has been one of the "key problems in industrial and organizational psychology, as evidenced by the massive efforts designed to clarify its theory and improve its measurement" (Smith, 1976, p. 745). Smith specifies three requirements of a criterion of performance:

- a. that it be relevant of some organizational or individual goal, but neither biased nor trivial;
- b. that it be reliable and "involves agreement between different evaluations, at different periods of time and with different although apparently similar measures" (Smith, p. 746);
- c. that it be practical: that is, available, plausible and acceptable to those who will use it for decisions.

Another issue that has received much research is the choice between a single performance criterion and multiple criteria. In the classical model, the emphasis was on a single criterion which met all the requirements mentioned above (Guion, 1976, p. 783), but the weight of recent opinion is towards multiple criteria (Smith, 1976, p. 747). The first argument in favour of the multiple criteria solution is on logical grounds: the various possible criteria are all different ways of measuring the same unitary concept and using more than one measure gives a better estimate of this concept's true value. It could be that two individuals with equivalent total performances could achieve these results through quite different behaviour patterns. The other argument for multiple criteria is empirical: "an overwhelming majority of studies involving statistical analyses of sets of criterion measures finds that these analyses rarely yield a single general





factor...several criterion measures are necessary to account for the variance in a criterion correlation matrix" (Smith, 1976, p. 748). The choice of criteria and how to combine them are difficult processes and must all too often be based on convenience rather than their relevance to long term effectiveness.

Several recent studies have proposed the use of utility concepts in performance measurement which could be used as a criterion (Landy, Farr and Jacobs, 1982; Schmidt and Hunter, 1981). Utility concepts include such things as the number of successful employees hired, increases in the average level of performance, and the amount of savings in dollars and cents, as a means of evaluating the effects of various selection strategies. Most recent applications of utility concepts deal with the value to the organisation of the hired individual which was derived by estimating the average value and the standard deviation of performance expressed in dollars. These criteria as they stand are inappropriate for the present study, but the application of utility analysis is discussed below in relation to the determination of optimum cutting scores on predictors.

In addition, Smith (1976) suggests several other variables which have been found useful as providing "hard" and "soft" criterion measures. Under the hard category are tardiness, absences, accidents, tenure or turnover, sales, production, job level and promotions. Even these may contain some soft elements largely due to the effects of human judgements. The soft criteria are those which involve the use of rating scales, usually completed by supervisors. There are a large number of sources of rating scale error, and an even larger number of methods to minimise their effects (see Landy and Farr, 1979; Smith, 1976, pp. 757-764), but these will not be considered in detail here.





## 5. Predictor Selection

In trying to select tests which may serve as predictors, Guion (1976) suggests three criteria:

- a. complex behavior (i.e. the criterion) cannot be fully predicted by simple means, thus a single predictor is usually inappropriate;
- b. complex performance is a function of the individual, but only to a certain extent, therefore in thinking of predictors, it is pertinent to go beyond individual traits and include situational and demographic variables as sources of potential predictors; and
- c. complex behavior is not likely to be optimally predicted in precisely the same way for all people, while it is not feasible to have prediction equations for each individual, it may be possible to develop different equations for logically different subgroups.

He also suggests many publications to consult (e.g. Ghiselli, 1966) which provide a summary of predictive validities for various job categories, by type of predictor and by type of criterion. They are, he suggests, a good starting point.

## 6. Validation

To this point the concept of validity has been described as a correlation coefficient which expresses the relationship between predictor and criterion measures. However, this concept can be extended. As noted by Campbell (1976), the correlation coefficient approach to validity implies:

- a. "there is one normally distributed criterion or criterion composite;



- b. there is one normally distributed predictor or predictor composite; (and)
- c. the relationship between them is linear and homoscedastic." (p. 205)

These are stringent conditions and are often violated. He further challenges the practical use of a validity coefficient: how are decision makers to use say, the value of .55, in determining which of a group of applicants should be selected? The coefficient says little about how to produce the desired outcome. Provided the above three conditions are met, the validity coefficient is useful for determining which of a group of predictors is more appropriate for selection but Campbell describes what he calls "decision centered" validity as a more useful approach.

With a decision orientation, selection research is viewed an attempt to predict discrete outcomes on a criterion which is categorical in nature. The categories to be predicted are made up of those who succeed against those who fail. The task for the predictor then is to establish a "cutting" score which maximises the proportion of correct predictions. But how is the proportion of correct predictions to be defined? In the equations below, the figures A, B, C, and D all refer to the numbers of personnel by predictor/criterion outcome. A is the number who are predicted to pass the criterion and who do, in fact, pass. B is the number who are correctly predicted to fail the criterion. C is the number who are predicted to pass but who subsequently fail the criterion. Finally, D is the number who are predicted to fail but who would have passed. Using these figures, two examples of how the proportion of correct classifications may be defined are as follows. One method, Equation 2.1, is to take the proportion of correct classifications over the total number to classify. Another



approach, Equation 2.2, takes as the statistic the number of successes over the total number who pass. There could be other possible definitions. However for both equations, the idea is to select a "cutting" score on the predictor which maximizes the value of the expression. What is forgotten in both these definitions is that each embodies a value judgement in the way the statistic is defined. Equation 2.1

$$CP = (A + E) / (A + E + C + D) \quad (\text{eqn 2.1})$$

$$CP = (A) / (A + C) \quad (\text{eqn 2.2})$$

applies an equal weight to both correct prediction outcomes, and does not distinguish between the two types of error (categories C and D in the equations) in terms of their (negative) value to the organisation. Equation 2.2 ignores completely the outcomes for individuals who are not in the predicted success group, in effect assigning a value of zero to each of these outcomes. The question arises then as to what values should be assigned to each outcome for the four possibilities, given in the equations, to derive an appropriate cutting score?

The answer lies in the application of the concept of utility which was referred to briefly above. As described by Campbell (1976), utilities are estimated for each outcome in Equations 2.1 and 2.2. For simplicity in the following discussion, the terms pass and fail refer to criterion results whereas positive and negative refer to predictor score results. Thus, outcome A is a pass/positive outcome: these members are correctly predicted to pass on the criterion. An example of the application of utilities and how they are maximised by varying the cutting score is given



TABLE II

## Total Expected Utility for a Predictor Cut-off Value

## A. Fixed relative utilities for each outcome

Success	-5	10
Failure	10	-30
	Predict Failure	Predict Success

## B. Probability of each outcome for a certain cut-off

Success	.16	.24	.40
Failure	.48	.12	.60
	Predict Failure	Predict Success	

## C. Products of utilities and probabilities

Success	-.80	2.4
Failure	4.8	-3.6
	Predict Failure	Predict Success

Total expected utility for this cut-off = 2.80

in Table II (this example is very similar to that given by Campbell, 1976, p. 212). As can be seen from Table II, part A, the pass/positive outcome is given a value of 10 units of utility which is the same value as the fail/negative outcome. This implies that it is as valuable to the organisation to predict a success as it is to correctly predict a failure. The negative signs in the other two cells suggest that each outcome is a disutility to the organisation. Further, it is clear that the relative values in these cells indicate that the disutility of incorrectly identifying a





failure, is far greater than incorrectly identifying an individual who would have been successful. In fact the former disutility is six times as great and it is not difficult to see why this would be so. Allowing a future failing individual in to the organisation is much more expensive because of the larger amount of investment which is lost (e.g. training expenses, salary) compared with the relatively small investment lost on the rejected applicant who would have been a success. The question remains however as to how to use these utilities in the deriving selection cut-offs.

To see how the utility values are used for determining the effectiveness of a selection procedure, it is necessary to examine all three parts of Table II. Part B shows the proportion of the sample residing in each cell based upon a cut-off score on the predictor. It forecasts that 38% of the applicants will be successful. Treating these cell entries as a probability of belonging to that cell, it is now possible to calculate the expected utility for each cell by multiplying the probability by the corresponding utility. The result is shown in part C of the table. For a cutting point of 38% predicted successes, the total expected utility is simply the sum of each of these cells: 2.8 is the expected utility for this particular cutting score. Using this same procedure the next possible cut-off score on the predictor can be evaluated. Clearly, this cut-off will most probably produce different proportions of cases in each cell, which will in turn change the value of the total expected utility. Continuing this process for all possible cut-offs produces a total expected utility for each cut-off level. The cut-off which should be chosen is the one that maximises the expected utility. Of course if all cut-off levels result in negative expected total utility, then the selection device is of no use to the organisation and it should not be used.



Within the US Navy setting, it is possible to make estimations of the various utilities associated with each of the four possible predictor/criterion outcomes through cost and productivity analyses by rating. Utilities for three of the four possible outcomes appear to be relatively straightforward, provided some simplifying assumptions are made. These three (associated with A, B and C in the equations) may be estimated from the Billet Cost Model (Assessment Group, 1983). However, the disutility of the other cell, misclassified pass (D in the equations) is more difficult. For the defense force the disutility of this outcome is very much a function of the recruiting market. During lean recruiting times, when quotas are hard to fill, to reject a potentially successful candidate has greater disutility than it would in the current recruiting climate. The utilities associated with the other three cells should be impervious to such fluctuations. The actual derivation of utilities is discussed in the Method chapter.

## 7. Cross Validation

Depending on the statistical technique employed, the results of selection standards research will be effected by certain characteristics specific to the sample used in the study (Weiss, 1976, p. 332). This means that the results will reflect not only the true relationships between the criterion and predictor variables, but they will also reflect relationships which are unique to that particular sample, and this uniqueness may not be generalised to the population. To avoid these problems selection results are usually cross-validated.

It is not necessary to cross-validate in the same manner which was described for the classical selection model. This would involve the complete replication of the original research on a new group of subjects. More efficient



and less costly methods are available. Campbell (1976, p. 214) describes what he calls the 'double cross-validation' design. Here the sample is randomly split into two equally sized subsamples. The statistical techniques are applied independently to each subsample to derive the decision rules for the final version of the selection device. The decision rules for subsample 1 are applied to subsample 2 and the validity estimated. The decision rules for subsample 2 are applied to subsample 1 and another coefficient is calculated. The average of these two coefficients gives the validity for the procedures. Ideally, of course, the decision rules for each subsample will be essentially the same. Marked deviation between subsamples indicates that either one or both results are sample specific and therefore they would be suspect.

The double cross-validation design could apply equally well to the utility method for estimating the optimal cut-off values. Cut-offs could be determined on predictors for one group and then compared with the cutoffs derived from these same predictors on the other subsample.

## B. RESULTS FROM PREVIOUS RESEARCH

As was indicated earlier, there is a great deal of research literature on personnel selection within organisations. This includes studies for almost every conceivable employment type both across the community and, within and by, the services. The purpose of this section is to include sufficient of the previous research so as to get a basis for formulating research hypotheses in the next chapter. It is neither intended nor claimed that what follows is an all inclusive review of personnel selection research.





## 1. General Results

The history of mental testing is intertwined with that of personnel selection in organisations. During the 1950's and 1960's, many organisations adopted the IQ as a standard measurement for use in selection and placement in virtually any employment setting. But the whole area of human ability testing, including the concept of IQ, came under fire in the late 1960's. The civil rights movement had a lot to do with this, as articles and monographs (e.g. Jensen, 1973) indicated that there were significant minority score differences on these tests. Further, there were claims that minority groups were disadvantaged, through test bias, by organisations which employed psychological tests in their selection procedures. In a recent article Carroll and Horn (1981) sought to make a distinction between the science and the application of human ability measurement. They claimed that the science of human abilities was in a "haze of confusion (as evidenced) when ideas about human abilities are regarded as equivalent to ideas about IQ measurements (and) that valid criticism of particular applications of measurements are not, in general, criticisms of the science of ability measurement" (page 103). They argue that there is no particular fault with the scientific aspects of human ability measurement, claiming that 80% of the variance of ability differences is accountable in test measurement, and suggesting that the application of these tests has caused the difficulty.

Schmidt and Hunter (1981) also discuss this issue, but in a more applied sense. They have derived, over the last five years or so, a procedure for evaluating the significance of individual validity studies, in which they say it is sometimes difficult to detect the presence or effect of sampling bias. Specifically, they directly address many of





the criticisms of mental testing put forward in the last decade. These include the notions of low utility (selection procedures have little direct bearing on organisational productivity), test unfairness (selection procedures are biased against minorities) and test invalidity (selection test validities may be situation or job specific and not truly general). Numerous recent studies are referenced in support of the idea that selection procedures do not have low utility. This leads to the conclusion that the potential effects of employment testing on productivity have been underestimated. The authors deal with test unfairness by suggesting that the factors causing low test scores also produce poorer job performance, for both majority and minority groups. They conclude that employment tests do not cause adverse impacts against minorities and they seem to support Jensen (1980), who demonstrated that when minorities are selected on procedures developed on white samples the minority group is favoured (see Jensen, 1980, p. 515). The third issue of test invalidity is similarly argued with the presentation of many studies which support the notion that tests are valid for employment prediction. One relevant study showed that when jobs were grouped according "to complexity of information-processing requirements, the validities of a composite of verbal and quantitative abilities for predicting on-the-job performance varied from .56 for the highest level job to .23 for the lowest" (page 1133). This is an interesting finding considering the emphasis in this thesis on selection for various complexity levels. It suggests, first, that cognitive ability should be valid for predicting job performance and, second, that the validity should increase with job complexity. Smith and Hunter reach three conclusions:

- a. professionally developed ability tests are valid



predictors of performance both on-the-job and in training for all jobs;

- b. ability tests are fair to minority groups as they do not underestimate the expected job performance of minorities; and
- c. ability tests used in selection can effect huge labour and cost savings in an organisation.

In contrast to Schmidt and Hunter's paper, which makes a frontal attack on the critics of ability testing, Reilly and Chao (1982) examine the validity and fairness of some alternative selection procedures as is required by government regulation where there are adverse minority effects. Of the eight alternatives, two are relevant for the present study. These are biographical data and academic performance measures. Biographical data is that type of information usually given by an application for a job, and includes such things as age, number of years schooling, marital status and number of dependents. These data have been successfully used in predictive cross-validated studies, returning validities not as large as for ability tests, but sufficiently close to suggest they could be a feasible alternative. Academic performance measures, such as grade point averages and course results, have not fared so well. Validities based on performance criteria for these items have been either insignificant or extremely low. They are not recommended as an alternative.

In sum, therefore, it is clear that mental ability tests are relatively valid predictors of job performance in virtually all settings, and that biographical data are also useful and valid as predictors. Higher validities have been found for more complex jobs when compared with jobs of low complexity.



## 2. Military Research

As was indicated in the introduction, the military has been a very fertile ground for research in, and the application of, selection standards technology. Almost 150 studies on the US military were recently reviewed by Vineberg and Joyner (1982). These occurred between 1952 and 1980 and were selected because they were job performance prediction studies. The authors' paper dealt with criterion and predictor variables and the usual technical measure of validity (i.e. the correlation coefficient) associated with different combinations of these variables. This extensive survey article is discussed in the next few paragraphs.

Vineberg and Joyner categorise the criterion variables used in military studies into three types: proficiency, job performance and suitability. Proficiency variables are objective type measures of either job knowledge, task and/or task element performance. Job performance is expressed as either global ratings, job element ratings (both of which are subject to the rating scale errors referred to above), productivity (applied only to Army recruiters) and the grade or skill level obtained. The suitability criteria are made up of such things as length of service, completion of enlistment term, misconduct measures and recommendations for re-enlistment. Within and across these subdivisions the best median validities obtained were for job knowledge (.40), task performance (.31), suitability (.24) and global rating (.15) from a total of 350 validity coefficients. Based on these values, the authors conclude that the task performance and suitability validities are high enough to suggest they would be useful in selecting military personnel.

Many different types of predictors have been used as the independent variables in selection research. The most popular is aptitude (e.g. mental tests), followed closely by



biographic and demographic variables. In most aptitude studies at least one other type of predictor was used. Age and education level (expressed as number of years schooling) were the most frequently used biographical variables. When predicting suitability criteria, the variables age, mental ability and education have consistently been found to be significant. The median validities are: education (.36), mental ability (.24) and age (.21). When all three of these variables are taken into account simultaneously, then validities have ranged from .24 to .39. Some evidence is presented which suggests that when some early military experiences are taken into account (e.g. ratings at recruit training), then the validities for prediction range from the .40s to the .60s.

While the authors conclude that the research suggests the usefulness of these predictors to forecast performances on these criteria, they make two relevant points about the relationship of the variables and how the validities may be improved upon (page 22). The first point is similar to one made earlier in this paper: there are likely to be many important differences within and across jobs, and these need to be taken into account when theorising about what kinds of relationships exist. Jobs may differ in terms of job difficulty, the level of effective ceiling of performance and how many of the incumbents reach this level of performance. These kinds of factors effect what the criterion measure should be and how it should be measured. The present study hopes to address specifically the issue of job complexity.

The second point is that predictor and criterion relationships are not likely to be static over time. With experience on-the-job, those predictors which were useful for predicting "early" criteria of performance tend to "wash out". It may be that as training and experience tend to







make the differences in technical proficiency smaller and less significant, then predictors are less able to discriminate between the performances. These points tend to emphasise the notion that the expected relationships between predictors and criteria might not be found in a sample, but also that there are probably many alternative explanations for insignificant results.

Studies of predicting military performance have been done in other countries, with similar kinds of results. Some of the more recent ones are summarised by Johnson (1982). An earlier paper, quite relevant to the present study, was done by O'Gorman (1972). He studied regular entrants to the Australian Army and found that a total of ten pre-enlistment variables combined in linear multiple regression were useful in predicting an effectiveness measure of performance. The criterion consisted of assigning the value "1" to those who did not complete their service for reasons other than death or illness, "2" to those who completed three years without promotion, and "3" to those who completed three years and who were promoted to corporal or higher. The significant predictor variables included age, marital status, aptitude scores (general ability and clerical ability), results on a psychiatric inventory, birth order and prior service.

More specifically for the current thesis, there has been some recent pilot research (Lurie 1981) about determining selection standards for the Ships Serviceman rating. In this study Lurie attempted to relate pre-entry variables to an improved criterion of Navy success: rather than the survivability of recruits during their first term he attempted to employ a job performance criterion to determine selection standards. His criterion was a combined advancement and survivalability measure, the object being to predict this variable given AFQT score, age, number of



TABLE III

Percentage of SHs scoring below designated AFQT Score

Grade	AFQT =< 20	AFQT =< 50
E-1	54	83
E-2	50	85
E-3	45	78
E-4	34	70
E-5	30	62

Source: Lurie, P.E. "Relating Enlistment Standards to Job Performance: A Pilot Study for Two Navy Ratings"  
CNA No. 81-0048 of 15 Jan 1981.

primary dependents and years of education for a cohort group of enlistees. His study used a cohort which joined the Navy in 1973, and records of their service were available up until 1977, allowing for advancement to E5. Regression models were used in calculating the relationships between the variables which allowed for the construction of "service status" probabilities. These probabilities show for various amounts of time in service the likelihood that the sailor will be either advanced/demoted to a particular rank, or discharged from the service. Without controlling for education, Lurie's data (see Table III) show an expected relationship between grade and AFQT. While the numbers are a little confusing, it is clear that as rank increases then the proportion of low AFQT scores declines. However, what is not obvious from Table III is the combined effect of high school graduation and AFQT. Lurie found that high school graduate enlistees with higher AFQT scores, have a better chance of advancement to E3 and E4, while the lower AFQT scorers have a higher rate of attrition. For non-high school graduates, the probabilities indicate that recruits with



lower AFQT scores outperform those with the higher scores. This rather striking result cannot be attributed to differential attrition rates as these are virtually identical for both low and high AFQT scorers. Non-high school graduate recruits with lower AFQTs advance more quickly to E4 and E5 than do high scorers. On the other hand, high scorers have a much higher chance of being reduced in rank than the low scorers. Lurie suggests that perhaps non-high school graduates with high AFQTs are dissatisfied with their placement as SHs believing they should be better employed. However no data is presented to support this notion. His overall conclusion is that it appears feasible to set enlistment standards for this rating based upon performance criteria. Unfortunately, his recommendations do not suggest any new standards.

## C. SUMMARY

### 1. Theory

It is now possible to give a short summary of the theoretical literature in this chapter. This is given in point form.

- there are both intrinsic and extrinsic pressures for an organisation to be interested and able to validate its selection procedures.
- validation of selection standards can take either the 'predictive' or 'concurrent' research design as they produce equivalent results.
- all selection research should begin with a thorough job analysis so that relevant information is obtained to assist in the development of both criterion and predictor concepts.
- certain principles are known which assist in the



selection of criterion and predictor measures.

- validity coefficients are susceptible to shrinkage due to a number of factors which may be controlled or adjusted for.
- while correlation coefficients are useful in selecting the most relevant predictors from a large number of potential predictors and as a technical statistic of validity, alone they do not indicate precisely what the selection procedures should be.
- providing utilities can be estimated for the various predictor/criterion outcomes, the decision centered validity design appears the most practical and useful to determine predictor cut-offs which maximise utility and which ultimately determine the selection system's overall usefulness.
- the double cross-validation design is a means of overcoming some sources of sample specific bias in selection standards research.

## 2. Empirical Results

From the review of previous studies the following points may be summarised.

- intra- and inter-job differences (e.g. complexity) are likely to effect the relationship between predictor and criterion measures.
- validity coefficients for more complex jobs are likely to be higher than less complex ones.
- relationships between criterion and predictor variables are not likely to be stable over time as training and experience appear to "wash out" these





relationships by reducing differences in criterion performances.

- significant predictor measures found in military studies include age, marital status, education, ability test scores and other biographical variables.
- criterion measures used previously in the military have included the following either singly or as composites: length of service, advancement, recommendations for re-enlistment and various misconduct measures.
- some recent studies (e.g. Lurie, 1981) have emphasised the unusual moderating effect some variables may have on predictors.



### III. AIM AND PURPOSE OF THIS RESEARCH

This chapter is designed to make a clear statement of the aim and purpose of the thesis. It is a chance to synthesise the literature survey of the previous chapter into a form which indicates the expected outcome from the analysis of the ratings chosen for study. The general design of the research and a statement of the research hypotheses are also given.

#### A. PURPOSE OF RESEARCH

The overall purpose of the present research is to analyse the available data on a cohort of entrants to three US Navy ratings in order to test the possibility that the current selection procedures can be improved. The ratings are Ships' Serviceman, Personnelman and Aviation Technician. The study involves the development of selection standards which it is hoped will enhance the total effective performance of future entrants to these ratings.

There are several secondary purposes. Inter-rating differences will be examined in relation to the level of complexity of each rating. To this end, ratings have been chosen deliberately with the intention of having a wide spread in terms of job complexity. The research is intended to examine rating differences with respect to different criteria of performance both for single and composite measures. Finally, it is intended to apply the concepts of utility analysis (that is, applying estimates of the cost and the productivity of sailors) as a means of determining the selection procedure which will yield the maximum pay-off in terms of total expected return to the Navy.



## B. AIM

The aim of this thesis is to investigate the possibility of improving the selection standards for three US Navy ratings.

## C. DESIGN

In terms of the theoretical literature, the design of the present study is more 'predictive' than it is 'concurrent'. It is not strictly 'predictive' in the classical sense, as it does not include data on all applicants for the US Navy, but rather has information on applicants who were subsequently enlisted. The research is somewhat 'concurrent' in that sailors within a rating are included for analysis provided they met at least one of the three criteria of inclusion discussed in a later section.

After the selection of appropriate predictor and criterion measures, the next feature of the design is the use of double cross-validation coefficients as an overall gauge of the usefulness of the relationship between predictors and criteria as a selection tool. This involves the random splitting of the total sample into two halves, developing a linear regression relationship for each half, then testing the correlation between predictions and criterion measures in opposite halves, and averaging these correlations to get an average validity coefficient. In essence, using the data from one half to predict the behaviour of the other half.

Using these linear regressions models, it is intended to apply estimates of utility and disutility (i.e. the extent to which a particular selection outcome gives a positive or negative return to the employer) in order to establish the optimal cut-off value of predictions to maximise the total expected utility. This cut-off value will be expressed as a



percentage improvement on the total utility obtainable when the predictive equation is not used.

The design also includes an analysis of the effects of moderator variables (these are variables which interact with the predictors). One of the most important in this study is job complexity. Others which have been shown to be significant in other studies, and which will be addressed in this study, are race and sex.

#### D. RESEARCH HYPOTHESES

While this research is more empirical than theory based, it is possible to formulate at least two research hypotheses based on past findings.

##### 1. Hypothesis\_1

Age, educational level and mental ability/aptitude will be amongst the variables found to be significant predictors of criterion performances.

##### 2. Hypothesis\_2

Validities of the predictor/criterion regression equations will tend to increase as the level of complexity of the Navy rating increases.





#### IV. METHOD

This chapter describes the execution of the research. On a section by section basis it deals with: the ratings selected, the data base, the variables used, the subjects chosen and the statistical analyses employed.

##### A. NAVY RATINGS SELECTED

As has already been mentioned, the ratings in this study are Ships Serviceman, Personnelman and Aviation Technician. They were chosen because they represent varying degrees of job complexity. According to a complexity scale (see Sands, 1979) these ratings have values of :

- a. Ships Serviceman : 40
- b. Personnelman : 67
- c. Aviation Technician : 95

The whole scale has a range from 10 to 99, with a median value of 70, and the most complex rating assigned a 99. These ratings therefore are representative of the spread of complexity of ratings in the US Navy.

Admittedly, the ratings differ in terms of the nature of the work as well as in complexity. This could well be a significant cause of rating differences and may influence the outcome of the study. A more ideal approach would have been to select different levels of complexity within the same type of employment. However, the data did not allow such a fine classification of personnel.



Another variable which will obviously have an effect on the outcome of this study is the fact that for all ratings an existing selection procedure is in use. It requires that entrants exceed particular ASVAB subtest scores, as well as reaching a certain SCREEN score. The SCREEN score is explained in detail later, but it is a probability which represents the chances of the applicant completing his period of service (Sands, 1979). The probability is derived from a consideration of race, AFQT, marital status and high school diploma status. Such prescreening will tend to restrict the range of both predictor and criterion variables which will have an effect on validity coefficients.

A general description of each rating, which is taken principally from the US Navy's "Enlisted Career Guide 1981-82", follows.

#### 1. Ships Serviceman (SH)

At a primary level, depending upon their specialty, the SH may work in a barber shop, ship's store, laundry, dry cleaning plant or office. Subsequently they may assume more responsibility in supervisory and managerial roles associated with retail stores, commissary stores and laundry/dry cleaning plants. Among the distinguishing characteristics of this particular rating is an emphasis on basic interpersonal skills. While the actual employment may vary in physical surroundings and requirements, the jobs all have a lot to do with dealing and interacting with other people. An affinity for dealing with people is therefore essential. Although there is not a requirement for high level cognitive skills, it is nonetheless important for SHs to be of above average ability in arithmetic and in such things as record-keeping and detail work. After recruit training, the SH attends a 6 weeks' course in the trade. There are about 5,000 personnel employed in this rating at present.



## 2. Personnelman (PN)

The Navy's Personnelman is a rating which specializes in clerical and counselling duties with respect to personnel. They provide information and counselling to enlisted sailors related to Navy occupations, opportunities for general education and job training, promotion requirements, and in rights and benefits. After recruit training, the PN completes a 6 to 7 week technical school. There are about 7,000 personnel employed in this rating at present.

## 3. Aviation Technician (AT)

The full title of this rating is Aviation Electronics Technician. As the title suggests, sailors in the rating are employed maintaining advanced radio, radar and electronics equipment that are carried on board aircraft. Within this broad area of responsibility, there are three categories of employment. The AT may be involved in testing and analysis of equipment, its maintenance and repair, and in related administrative tasks. After recruit training, the AT attends up to 6 months of full-time schooling, and depending upon whether the AT is a four or six year obligator, he/she goes on to do a further 6 months of advanced first term avionics. The rating employs about 10,000 personnel at present, and there are shortages of ATs.

## B. DATA BASE

The cohort data base was assembled by the Defense Manpower Data Centre (DMDC) for the Administrative Science Department of the Navy Postgraduate School (NPS). Cohort data on some 206,000 non-prior service sailors were obtained through the merging of three usually separate Navy files. These files are referred to as the DMDC file, the Advancement file, and the Navy Health and Research Center (NHRC) file.



The DMDC file contains pre-enlistment variables as well as entry dates and current status. It was assembled by linking various copies of the Enlisted Master Record across time using Social Security number. This number was deleted in the final cohort file in the interests of privacy.

The Advancement file records variables related to the promotion of individuals through the advancement system. For example, this file provided values for the Final Multiple, a composite score, which determines whether the sailor is promoted.

The NHRC file contains many of the same pre-entry variables as the DMDC file, but records additional pre- and post-entry variables. Amongst these are aptitude scores on the Armed Services Vocational Aptitude Battery (ASVAB) subtests and percentile scores on the Armed Forces Qualification Test (AFQT). The file also contains such things as the total number of absences without leave (AWOLs), demotions, desertions and the times for promotion to various grades (eg number of days to E4). NHRC is the largest of the three files.

The cohort file included data from all enlisted entrants to the Navy between 1 September 1976 and 31 December 1978. No special data collect or monitoring of these subjects was set up; rather snapshots of their progress were taken in September 1982 from the various files to create the NPS cohort file. The time period allowed each enlistee the opportunity of serving about four years, with some being able to serve as long as six years.

### C. VARIABLES IN THE DATA BASE

There are over 260 individual variables in the cohort data base, and those relevant for this study are described below.





## 1. Criterion Variables

Three criterion variables are used. One is unitary while the others are composites. The singular criterion is total length of service in months. This is available on all members of the cohort and is a true metric scale suitable for regression analysis. The second criterion is a positively oriented ordinal scale. Three mutual exclusive and collectively exhaustive categories of criterion outcomes are identified. Those individuals who did not complete four years of service for other than medical, death or officer entrance reasons, were grouped in the first category. Those who completed four years' service were placed in the second category. Those who served four years and were rated (i.e. became qualified in the rating), graded E4 and recommended for re-enlistment were placed in the third category. For the purposes of statistical analyses, these three categories were given the values "10", "20" and "30" respectively. Since this scale attempts to differentiate the better sailors from the others, it is known as the 'goodguy' scale. The third criterion is negatively oriented and is known as the 'badguy' scale. The first category includes those who did not complete four years of service, who had been discharged for negatively oriented reasons, and had either desertion, AWOL or confinements recorded against them and received a value of "10". The second ordinal category includes those who did not complete four years of service, or those who had demotions or were not recommended for re-enlistment regardless of their length of service and was valued "20". The remainder of the group, who did not exhibit any particularly negative behaviours, were placed in the third category which was valued "30".



While these criteria could be defined in different ways, they seem to be consistent with the three requirements suggested in Chapter II.

## 2. Predictor Variables

The following potential predictor variables are contained in the cohort file. They are:

- a. age at entry;
- b. marital status;
- c. highest education level reached;
- d. number of dependents;
- e. various ASVAB subtest scores (in raw score form);
- f. AFQT percentile scores;
- g. groupings based on AFQT scores;
- h. entry pay grade; and
- i. SCREEN score (which is the probability of completing the period of enlistment based on education, AFQT and race).

These variables have all been previously associated with predicting criterion measures in military and non military settings. They are consistent with the three requirements for predictors mentioned in the literature survey.

## 3. Moderator Variables

As was pointed out earlier, it is suspected that complexity plays a moderating role. This has been accounted for, partially at least, by choosing three ratings which cover a wide span of complexity, and for which different selection procedures will be developed.



Race is another variable which may play a moderating role. Provided there are no adverse impacts for minorities, as measured by hiring rates, it may be possible to apply the same selection procedures across race, to the rating as a whole. Alternatively, selection procedures based specifically on race groupings may produce a better overall result. In any case, previous research emphasises wisdom of taking race into account.

Sex is another variable which is believed to play a moderating role in this research. In this study, there is a sufficient number of white females to perform analyses on two rating groups (these are PN and AT).

#### 4. Screening of the Variables

While the accuracy of data entries into the original three data files is unknown, it is assumed to be very high. However, some cases were identified in the cohort data set which had impossible values. For example, no entrant to the Navy can be less than 17 years old, but some cohort members were listed with an entry age less than 17. These cases were excluded. Similarly, each of the ASVAB subtests has a known maximum number of items, thus cases with scores higher than these limits were excluded. Because the criterion measures all required that each sailor have the opportunity of serving for at least four years, then those sailors whose enlistment dates precluded serving this period were excluded.

The exclusion of cases for these reasons was 'list-wise'. That is, the case and all its variable values was deleted. The percentage of cases deleted in this way amounted to less than 5%.



## 5. Estimates of Utility

As was argued in Chapter II, if a significant relationship between predictors and the criterion is found, then estimates of utility for various selection outcomes become important for deciding the optimum cut-off on the predictor to achieve the best overall selection result. This involves determining the cut-off level on the predictor for which total utility is maximised (see Table II and related discussion). This section discusses the derivation of the estimates of utility.

To estimate the utility associated with each of the four possible selection outcomes it is assumed that the Billet Cost Model (see Griffin, 1981, for an explanation of the cost components of this model) provides reasonable estimates. As is discussed by Campbell (1976), it is the inter-cell ratios which are important rather than the absolute values themselves. The Billet Cost Model provides a method of approximating these ratios.

For correctly predicting a successful sailor, who will complete four years of service, the total marginal cost is taken as the best estimate of utility. This is based on the assumption that the Navy compensates sailors at the full value of their marginal product. This is probably a conservative estimate as a recent paper (Butler, 1982) has suggested. Butler has calculated for the Electronic Technician Rating, based on the amount of training dollars the Navy spends on these sailors and their expected total service, that the Navy must expect a return in product considerably in excess of rating billet cost. Nevertheless, the total billet cost figure is accepted as the best estimate of utility for this outcome (i.e. correctly predicting success).





An estimation of the disutility of predicting success, when in fact the sailor fails the criterion, is provided by the rating cost estimates of Balis and Clay-Mendez (1982). Basically these data come from the Billet Cost Model, but include only a few of the elements of the original model. The Balis and Clay-Mendez cost amounts are the average replacement costs by ratings across so called quality gradings. The cost of the replacement of the highest quality grading is used in the present study as the estimate of the disutility of falsely predicting success.

Relevant product/cost figures are not available for the utilities associated with applicants who are rejected by the prediction device. However, these utilities are derived from the above estimates. In the case of the applicant correctly rejected (he/she would have failed on the criterion measure), it is argued that this selection outcome has the same utility as the disutility associated with the entrant who fails the criterion. Therefore, the 'Balis' cost data is used as the utility estimate for this selection outcome.

The disutility of the rejection of the potentially successful applicant is derived as follows. The disutility associated with this outcome depends on the recruiting market and whether it is easy or difficult to get sailors. In some circumstances it could be that there are so many good quality applicants that rejecting potentially successful applicants has little or no disutility. One extreme value for this utility, therefore, could be zero. At the other extreme, the disutility of rejecting these applicants could be equal in magnitude to the utility of enlisting a successful applicant. The estimate of the disutility of rejecting a potentially successful applicant is taken as the average of these two extremes. The utility values, by rating, are given in Table IV .



TABLE IV  
Relative Utilities by Rating

RATING	PREDICTOR ----- PREDICTOR		PREDICTOR ----- PREDICTOR	
	*** SUCCESS ***		*** FAILURE ***	
	Criterion Success	Criterion Failure	Criterion Success	Criterion Failure
SH	19260	-13077	-9630	13077
FN	18488	-14495	-9244	14495
AT	22297	-21210	-11149	21210

The above utilities are used to derive cut-off scores for all three criteria. For the Length of Service (LCS) criterion they are used directly as the utilities for each of the four possible selection outcomes. On the goodguy and badguy scales they are used as the basis of developing utilities as described below.

TABLE V  
Relative Goodguy Utilities by Rating

	PREDICTOR ----- PREDICTOR			PREDICTOR ----- PREDICTOR		
	*** SUCCESS ***			*** FAILURE ***		
	30	Criterion 20	10	30	Criterion 20	10
SH	28890	19260	-13077	-19260	-9630	13077
FN	27732	18488	-14495	-18488	-9244	14495
AT	33446	22297	-21210	-22297	-11149	21210

For the goodguy scale, there are three criterion outcomes, which for the purposes of establishing a cut-off, gives a total of six possible criterion/predictor combinations. The scale values 20 and 10 are taken to have utilities as shown in the above table. The utility of correctly



predicting a goodguy 30 is computed to be one and a half times the utility of correctly predicting a goodguy 20. As was done in developing the above values, the disutility of rejecting a sailor who would have been a goodguy 30 is taken as the simple average of its extreme values. As can be seen in Table V, the figure for SH is the average of 28890 and 9630.

TABLE VI  
Relative Badguy Utilities by Rating

	PREDICTOR SUCCESS ***			-----	PREDICTOR FAILURE ***		
	30	Criterion 20	10		30	Criterion 20	10
SH	19260	13077	-19616		-9630	-13077	16347
EN	18488	14495	-21743		-9244	-14495	18119
AT	22297	21210	-31815		-11149	-21210	26513

Similarly, the badguy utilities, shown in Table VI, were derived starting from those in Table IV. These four utilities represent the outcomes for bad guy criterion scores of 20 and 30. Again, it was figured that the utility of correctly identifying and rejecting badguy 10s was one and a half times the utility of correctly identifying a 20. As for the goodguy scale a simple average gave the utility for the other outcome.

#### D. SUBJECTS CHOSEN

Within the NPS cohort file there are three possible indicators of a sailor's rating. These are as follows. Firstly, there is a rating recorded at the time of entry. Secondly, when the sailor attempts the rating examination,



the resulting rating is recorded. Thirdly, the DMDC file contains a rating which is the sailor's official designation in terms of rating. These rating variables are known, respectively, as (1) entry rate, (2) examination rate and (3) DMDC rate.

It would be an ideal situation if all three rating variables agreed. However, there is considerable variation in the recordings of rating across these variables. In fact there are a total of seven different combinations when it comes to selecting suitable subjects for a particular rating. These seven possible combinations are shown in the Table VII.

TABLE VII  
Possibilities for Selecting Subjects within a Rating

Category	Rating Indicators		
	Entry	Exam	DMDC
1.	Yes	Yes	Yes
2.	Yes	Yes	No
3.	Yes	No	Yes
4.	Yes	No	No
5.	No	No	Yes
6.	No	Yes	Yes
7.	No	No	Yes

Note 1: 'Yes' means that the data file indicated that the sailor was a member of the rating according to the particular rating indicator.

Note 2: In choosing subjects who were representative of rating membership, all the above Categories except # 4. were used as selection criteria.





There are a number of ways for determining which subjects in the listed categories are representative of a rating. One method could be to select only those subjects who were coded in the rating for all three rating selection variables. But this approach would seriously restrict the sample size and, indeed, it would probably not produce a representative sample of the members of the rating.

Of the seven possible categories listed in Table VII, it was decided to initially select on all seven, then to exclude those sailors in category 4. That is, the exclusions were those Navy entrants for whom the only indication of membership of the rating was their entry code. It was reasoned that while these sailors showed an interest in the rating at some stage prior to entry, there is no indication that he/she had ever had any work experience in the rating. From a concurrent validity point of view, it is necessary for the subject sailors selected for a rating to at least experience it and to have their rating performances influenced by that experience. Presumably the sailors who were coded in the rating through the examination rate or through a DMDC code have had sufficient experience in the rating to be considered representative of the rating.

After these variable screens were applied, and the rating categories identified, subjects were chosen within each rating. These selections are shown by race and sex in Table VIII. As will be seen in the results section, it was decided that the numbers in some of the race/sex combinations were too small to perform realistic analysis. There are sufficient numbers of men in each race grouping. However there are enough white women in only the PN or AT ratings to perform regression and other analyses. Therefore, in all subsequent analyses, three groupings for SH, and four each, for PN and AT, are reported.



TABLE VIII  
Rating Selectees by Rating, Race and Sex

RATING	Sex	White	Black	Others	TOTAL
SH	Male	1330	572	169	2071
SH	Female	28	7	2	37
FN	Male	1263	288	112	1663
FN	Female	479	70	15	564
AT	Male	3400	176	114	3690
AT	Female	243	14	3	260

Note 1: The number of personnel are shown in each cell.

## E. STATISTICAL PROCEDURES

### 1. General

Now that the criterion, predictor and moderator variables have been indicated and the subjects identified, the statistical procedures will be described. The Statistical Analysis System (SAS) package (SAS, 1979) was used for the analyses, along with some FORTRAN programs written by the author. Sample programs are listed in Appendix A.

### 2. Descriptive Analyses

These are given by moderator variables, and consist of the score and/or mean values on predictor and criterion variables. No statistical tests are applied to these values, since where significant differences occur these are "captured" in the subsequent analyses.



### 3. Predictive Analyses

For each rating group the following steps are applied:

- a. stepwise regression is used to identify significant predictors;
- b. these significant predictors are used in 'ordinary least squares' regression to develop 'double cross-validation' validity coefficients; and
- c. regression weights are used to score each case on the respective predictor equations.

When the group size was small, the number of predictors used in the subsequent stepwise analysis, was limited to one variable to every 20 personnel. As a consequence, the 'other' racial category for ATs was limited to the first five variables selected in the stepwise procedure.

### 4. Estimation of Cut-offs

The 'ordinary least squares' regression equations are used to estimate optimum cut-offs as is described below.

In order to use the utility values to estimate the most ideal cut-offs on the predictors, it is first necessary to consider the LOS criterion measure as a dichotomous variable. Thus the sample is divided into two groups: those with less than four years and those with four years or more of service. The two three-point criterion scales were not recoded.

As is illustrated in the Appendix A, during the double cross-validation SAS run on the computer, criterion measures predictor scores and the variable race were output to a separate computer file which could be accessed by the FORTRAN program. The predictor score output at this stage



was derived in the following way: the separate regression coefficients, in each of the cross-validating samples, were used to separately score all the cases producing two predicted scores for each case. A simple average was taken, which represents the predictor score output for later FORTRAN analysis.

The method for estimating the most appropriate cut-off score was explained in Chapter II. In summary, the cutting score chosen is the one which maximises equation 4.1.

$$U_c = \text{Sum of } (Pr(i) * Ut(i)) \quad (\text{eqn 4.1})$$

where:

$U_c$  is the Total Utility for Cutting Score  $c$ .

$Pr(i)$  is the Probability of Outcome  $(i)$ .

$Ut(i)$  is the Utility of Outcome  $(i)$ .

The results of these analyses will be presented in graphical form. In order to get some frame of reference for evaluating the value of the chosen cut-off score, the cut-off is expressed as a percentage change from, what is known as base rate. The base rate is simply defined as the value of equation 4.1 when the cut-off is set so low that every applicant is accepted. Unfortunately, base rate is not the true utility of the current selection, since it represents the assessment of the utility only for those who are selected by these procedures, ignoring applicants who are rejected by them. As is discussed in Chapter VI, the overall utility of a selection device must take into account the costs involved in setting up and maintaining the system.





Thus, base rate, as defined here, is a utility estimate which ignores these external costs, but it provides an index figure for judging each potential cutting score. This index for each score is expressed as a percentage change, either positive or negative, from base rate.



## V. RESULTS

This chapter presents the thesis results and is organised into three sections. The first is descriptive, providing breakdowns on criterion, predictor and moderator variables. The second section details the predictive results. This includes the variables selected for multiple regression, and also the results of cross validation. In the last section, the results of the application of utilities to estimate appropriate cutting scores, are presented.

### A. DESCRIPTIVE RESULTS

#### 1. SH\_Groups

Shown in Table IX are the means and/or frequencies by category for potential predictor and criterion variables across the three male SH racial groupings. It is interesting to note that the length of service is greatest for non-white races. On the other hand, both the goodguy and badguy scales indicate that proportionally more of the white group have extreme values than do the other two races.

Among the predictor variables there are also some interesting trends. White personnel seem to be younger with lower educational level. However, with some exceptions, the white group's performances on the ASVAB subtests are better. This finding is consistent with this group's better AFQT scores.

#### 2. FN\_Groups

The same basic trends noted for SH men are evident for FN men, as is shown in Table X. The white men are slightly younger, they exhibit 'good' rather than 'bad'



TABLE IX  
Criterion and Predictor Values for SH Men

Variable		White	Black	Other
Number of Cases		1330	572	169
Mean LOS: months		44.99	49.31	50.82
Goodguy Scale	30	24%	16%	12%
	20	33%	49%	58%
	10	43%	35%	30%
Badguy Scale	30	23%	17%	14%
	20	51%	66%	72%
	10	26%	17%	14%
PREDICTOR MEANS				
Entry Age: years		18.7	19.4	21.0
Marital Status		1.3	1.4	1.5
Highest Education		11.6	11.8	12.2
Dependents (number)		.03	.05	.02
AFQT Percentile		46.6	34.7	32.3
AFQT Group		5.3	4.5	4.0
Entry Paygrade		1.1	1.2	1.1
SCREEN Score		80.2	79.4	80.2
ASVAB Subtests:				
Attention to Detail		14.6	13.8	12.9
Numerical Operations		32.1	28.1	27.3
Auto. Information		10.1	7.3	6.9
Attentiveness Scale		9.7	10.8	9.9
General Science		10.4	8.5	7.8
Electronics Scale		7.1	8.3	8.5
Math. Knowledge		11.4	9.3	8.9
Space Perception		12.1	11.1	11.0
Maintenance Scale		9.9	9.5	9.6
Electronic Info.		17.9	15.2	14.6
Arithmetic Reasoning		12.9	10.7	9.5
General Information		9.4	7.8	6.5
Word Knowledge		19.5	17.5	15.1
Shop Information		12.7	9.7	9.4
Combat Scale		15.9	14.1	13.4
Mech. Comprehension		9.5	7.4	6.9

Note 1: Goodguy: 30 .. served 4 years, promoted E4 and recommended for reenlistment.  
                   20 .. served 4 years.  
                   10 .. remainder after 20 and 30.

Note 2: Badguy: 30 .. remainder after 10 and 20.  
                   20 .. minor negative indicators.  
                   10 .. major negative indicators.

Note 3: Goodguy and Badguy percentages sum to 100%.

Note 4: AFQT groups: values 1 to 8, represent categories (in order) 5, 4C, 4B, 4A, 3B, 3A, 2 and 1.

Note 5: Marital Status: married (2); other (1).



TABLE X  
Criterion and Predictor Values for PN Groups

Variable		White	MALE Black	Other	FEMALE White
Number of Cases		1263	288	112	479
Mean LOS: months		48.72	49.53	51.94	45.67
Goodguy Scale	30	17%	9%	12%	21%
	20	48%	52%	63%	36%
	10	35%	39%	25%	43%
Badguy Scale	30	17%	9%	14%	22%
	20	72%	81%	79%	74%
	10	11%	10%	8%	4%
PREDICTOR MEANS					
Entry Age: years		19.8	20.7	21.1	20.0
Marital Status		1.4	1.4	1.5	1.5
Highest Education		12.1	12.2	12.7	12.2
Dependents (number)		.07	.06	.08	.05
AFQT Percentile		63.0	49.3	34.8	63.9
AFQT Group		6.2	5.5	3.9	6.3
Entry Paygrade		1.4	1.5	1.1	1.4
SCREEN Score		84.3	82.7	82.3	Ncne
ASVAB Subtests:					
Attention to Detail		15.0	14.0	11.8	16.1
Numerical Operations		35.4	30.6	25.6	37.8
Auto. Information		11.3	8.4	6.3	7.6
Attentiveness Scale		11.5	12.6	9.0	12.6
General Science		12.6	10.5	7.8	11.9
Electronics Scale		7.9	8.9	6.9	5.2
Math. Knowledge		13.7	11.1	8.8	13.8
Space Perception		12.6	11.1	9.4	12.9
Maintenance Scale		9.1	9.1	7.5	6.1
Electronic Inf.		19.8	16.7	13.4	16.8
Arithmetic Reasoning		15.0	12.4	9.3	14.3
General Information		10.6	8.6	6.2	8.1
Word Knowledge		23.7	22.0	14.7	24.6
Shop Information		13.6	10.7	8.7	9.9
Combat Scale		15.8	14.6	11.7	14.2
Mech. Comprehension		11.0	8.1	6.7	9.4

Notes: AS for Table IX.

behaviours, and are better performers on the ASVAB and the AFQT than are the men in the other racial groups.

The scores of the white PN women, not surprisingly, are closest to the scores of the white PN men. The women, however, have considerably shorter average lengths' of service, but exhibit a higher proportion of 'good' rather





TABLE XI  
Criterion and Predictor Values for AT Groups

Variable		White	MALE Black	Other	FEMALE White
Number of Cases		3339	172	109	242
Mean LOS: months		53.32	53.39	51.16	45.37
Goodguy Scale	30	18%	10%	18%	14%
	20	52%	57%	48%	44%
	10	30%	33%	34%	42%
Badguy Scale	30	19%	10%	16%	15%
	20	76%	83%	82%	76%
	10	5%	7%	2%	3%
PREDICTOR MEANS					
Entry Age: years		19.1	20.5	20.2	20.6
Marital Status		1.3	1.4	1.5	1.5
Highest Education		12.0	12.2	12.2	12.5
Dependents (number)		.06	.09	.08	.08
AFQT Percentile		72.5	56.5	55.6	70.7
AFQT Group		6.7	5.9	5.6	7.0
Entry Paygrade		1.9	1.8	1.5	1.8
SCREEN Score		86.2	83.6	83.9	None
ASVAB Subtests:					
Attention to Detail		15.2	14.5	15.5	16.7
Numerical Operations		35.5	31.4	33.5	40.5
Auto. Information		14.7	10.9	11.1	10.0
Attentiveness Scale		9.4	10.9	9.3	12.4
General Science		14.9	12.7	12.5	14.8
Electronics Scale		11.0	11.5	10.5	9.1
Math. Knowledge		16.0	13.9	14.5	16.6
Space Perception		14.9	13.2	14.0	15.3
Maintenance Scale		12.0	10.7	10.0	8.7
Electronic Infoc.		24.2	22.0	21.0	20.3
Arithmetic Reasoning		16.3	14.0	13.8	16.7
General Information		11.6	10.1	9.1	9.6
Word Knowledge		24.2	21.5	19.6	26.6
Shop Information		16.2	12.9	13.2	12.1
Combat Scale		16.4	14.6	14.4	15.8
Mech. Comprehension		14.5	10.7	11.7	11.5

Notes: As for Table IX.

'bad' behaviours. On ASVAB subtests the women, when compared with white men, are better on some scales (e.g. Numerical Operations and Word Knowledge), poorer on some others (e.g. Auto Information and Electronics Scale) and about the same on the remainder. On educational level, the women have entry educational levels which are within the



extremes of the three male racial categories on this variable. Incidentally, it is the male 'other' race category which has the highest educational level for the PN rating.

### 3. AT\_Groups

For the AT rating perhaps the most striking fact is the proportion of ATs who are white (see Table XI, about 92%). This is considerably larger than the equivalent percentages for PN ( 76% white ), and SH ( 64% white ).

The trends in the AT data are consistent with those already mentioned for PNs and SHs. Again, the white group is younger, with lower education level and generally better AFQT scores. However, for AT there are proportionally more Blacks in the negative category of the 'bad guy' scale (i.e. those scores of '10'). Women again have superior performances on some ASVAB scales and, for this rating, they have the highest education level.

## B. PREDICTIVE RESULTS

In this section the results of the stepwise regressions, in the form of the variables selected and the signs of the respective coefficients, are presented. These are followed immediately by validity estimates for the predictive models which are constructed. Regression coefficients and statistics are not listed in the body of the thesis: however, interested readers are directed to Appendix B where they are given in full.

### 1. Length\_of\_Service\_Criterion

For the SH rating, the variables selected as predictors on the length of service criterion by race, according to the sign of the coefficient, are shown on Table XII. Across races all the signs are consistent for predictors



TABLE XII  
Stepwise Regression for SH on LOS

Variable	White	Black	Other
Entry Age: years	n	n	Pos
Marital Status	Pos	Pos	n
Highest Education	n	Pos	n
Attention to Detail	n	n	Neg
Auto. Information	Neg	n	n
Attentiveness Scale	Neg	Neg	n
General Science	n	n	Pos
Arithmetic Reasoning	n	n	Neg
General Information	Neg	n	Neg
Mech. Comprehension	n	n	Neg
Combat Scale	n	Pos	n
AFQT Group	Neg	Neg	n
Entry Paygrade	Pos	n	n
SCREEN Score	Pos	Pos	n
Dependents (number)	Neg	n	n

Note  
Pos means the coefficient was positive.  
Neg means the coefficient was negative.  
'n' means the variable was not selected.

which entered the equation in more than one racial grouping. Entry age, marital status, educational level and entry paygrade are all positively related to length of service. Longer service is associated with higher values on these variables. Nearly all the predictive ASVAB subtests, and the AFQT groupings, are negatively related to length of service.

As shown in Table XIII, there are some differences in the signs associated with predictors for the PN groups for the length of service criterion. For whites and blacks, higher education is associated with shorter service, while for the 'other' race category, the reverse is true. There are mixed signs for the ASVAB subtests, but the SCREEN score consistently has a positive sign. Some ASVAB predictors for length of service, in the female group, have negative signs. Perhaps this is not surprising, because as was noted earlier, women tended to have shorter service but better ASVAB subtest scores than did men.



TABLE XIII  
Stepwise Regression for PN on LOS

Variable	White	MALE Black	Other	FEMALE White
Entry Age: years	Pos	n	n	n
Marital Status	Pos	Pos	n	n
Highest Education	Neg	Neg	pos	Neg
Attention to Detail	n	n	n	Neg
Numerical Operations	n	Neg	n	n
Electronics Scale	Pos	n	n	Pos
Electronic Info.	Pos	n	n	n
Arithmetic Reasoning	Neg	n	n	Neg
Word Knowledge	Neg	n	n	Neg
Combat Scale	n	Neg	n	n
Shop Information	Pos	n	n	n
AFQT Percentile	n	Neg	n	n
Entry Paygrade	n	n	n	Pos
SCREEN Score	Pos	Pos	n	n
Dependents (number)	Pos	Pos	Neg	n

Note

Pos means the coefficient was positive.  
 Neg means the coefficient was negative.  
 'n' means the variable was not selected.

TABLE XIV  
Stepwise Regression for AT on LOS

Variable	White	MALE Black	Other	FEMALE White
Entry Age: years	n	n	Pos	n
Marital Status	Pos	Pos	n	Neg
Highest Education	Neg	Neg	n	n
Numerical Operations	Neg	n	n	n
Auto. Information	n	n	Neg	n
Attentiveness Scale	n	Pos	n	n
General Science	Neg	Neg	n	n
Electronics Scale	Pos	n	n	Neg
Math. Knowledge	Neg	n	n	n
Space Perception	Neg	n	n	n
Maintenance Scale	n	n	Pos	Pos
Electronic Info.	n	n	Pos	Pos
Shop Information	n	Neg	n	n
AFQT Percentile	Pos	n	n	n
AFQT Group	Neg	n	n	n
Entry Paygrade	Pos	n	n	n
SCREEN Score	Pos	n	Pos	n

Note

Pos means the coefficient was positive.  
 Neg means the coefficient was negative.  
 'n' means the variable was not selected.





Like the SHs, there is a consistency of signs for stepwise entered predictors for the AT rating (see Table XIV) for length of service. However, the direction of the signs, for some variables, is different. For example, educational level for two racial groupings, is now negatively related to length of service. This sign change is carried over into the ASVAB subtests. Being such a technically complex rating, one would expect Science and Mathematics to be positively related to length of service. However both of these scales have negative signs. Consistent with some of the other stepwise regressions, SCREEN score is positively related to length of service.

## 2. Goodguy Criterion

Table XV shows the variables selected by race on the goodguy scale for the SH rating. This is the smallest

TABLE XV  
Stepwise Regression for SH on Goodguy

Variable	White	Black	Other
Marital Status	Pos	Pos	n
Highest Education	Pos	n	n
Auto. Information	n	n	Neg
Electronics Scale	Neg	n	n
Math. Knowledge	Pos	n	n
Electronic Info.	n	n	Neg
Combat Scale	n	Pos	Pos
AFQT Percentile	n	n	Neg
AFQT Group	n	Neg	n
SCREEN Score	n	Pos	Pos

Note  
Pos means the coefficient was positive.  
Neg means the coefficient was negative.  
'n' means the variable was not selected.

number of variables selected for any of the stepwise regressions. The signs are all consistent with the predictor selections for SH on length of service. However, it is interesting to note that AFQT percentile, for the 'other'



racial category, has a negative sign: lower AFQT percentiles are predictive of better goodguy performances.

TABLE XVI  
Stepwise Regression for PN on Goodguy

Variable	White	MALE Black	Other	FEMALE White
Marital Status	Pos	n	n	n
Highest Education	Neg	Neg	Pos	n
Attention to Detail	n	n	n	Neg
Numerical Operations	n	Neg	n	n
Electronics Scale	pos	Neg	n	n
Math. Knowledge	n	Pos	n	n
Mech. Comprehension	Pos	n	n	n
Electronic Infrc.	n	Pos	n	n
Arithmetic Reasoning	Neg	n	Pos	Neg
Word Knowledge	Neg	n	n	Neg
Constat Scale	n	n	Pos	n
General Information	n	Pos	n	n
Shop Information	n	Neg	Neg	n
AFQT Percentile	n	n	Neg	n
SCREEN Score	Pos	n	n	n
Dependents (number)	Pos	n	Neg	n

Note  
Pos means the coefficient was positive.  
Neg means the coefficient was negative.  
'n' means the variable was not selected.

As was the case on the length of service criterion for PN's, the level of education is negatively related to the goodguy scale. This is shown in Table XVI. ASVAB subtests selected have varying signs and for two racial groupings for men, the variable 'number of dependents' has entered the regression equation. The SCREEN score for white males is positively related to desirable goodguy behaviors.

For the AT groupings, on the goodguy scale, see Table XVII, there is little consistency regarding which variables are selected. Only three predictors were chosen in more than one grouping, and when this happened the signs are different across groups. It is interesting that for the largest group, white males, not a single ASVAB subtest is selected as a predictor.



TABLE XVII  
Stepwise Regression for AT on Goodguy

Variable	White	MALE Black	Other	FEMALE White
Marital Status	Pos	n	n	n
Highest Education	Pos	Neg	n	n
Attention to Detail	n	n	Pos	n
Attentiveness Scale	n	Pos	n	n
General Science	n	Neg	n	n
Electronics Scale	n	n	n	Neg
Maintenance Scale	n	n	n	Pos
Electronic Info.	n	n	Neg	Pos
Word Knowledge	n	n	Pos	n
AFQT Percentile	n	Pos	Neg	n
AFQT Group	n	Neg	n	n
Entry Paygrade	Neg	n	n	n
SCREEN Score	n	n	Pos	n

Note  
Pos means the coefficient was positive.  
Neg means the coefficient was negative.  
'n' means the variable was not selected.

### 3. Badguy Criterion

The SH rating, see Table XVIII, on this scale, shows a consistent trend for education to be positively related

TABLE XVIII  
Stepwise Regression for SH on Badguy

Variable	White	Black	Other
Entry Age: years	n	Neg	n
Marital Status	Pos	n	n
Highest Education	Pos	Pos	Pos
Numerical Operations	Pos	n	n
Auto. Information	n	n	Neg
Electronics Scale	Neg	n	n
Arithmetic Reasoning	n	Neg	n
Combat Scale	n	Pos	Pos
Word Knowledge	Neg	n	n
AFQT Percentile	n	n	Neg
AFQT Group	n	n	Pos
Entry Paygrade	Pos	n	n
SCREEN Score	Pos	n	n

Note  
Pos means the coefficient was positive.  
Neg means the coefficient was negative.  
'n' means the variable was not selected.



for all three racial groupings. Since the goodguy and the badguy scales are both scored in the same direction (i.e. the 'good' and 'bad' ends have the same numerical values), this means that higher education is associated with 'non-bad' behaviours. Several ASVAB subtests were selected, with differing signs. Entry paygrade and SCREEN score are both positive.

TABLE XIX  
Stepwise Regression for PN on Badguy

Variable	White	MALE Black	Other	FEMALE White
Entry Age: years	n	Neg	n	n
Highest Education	n	n	Pos	Pos
Attention to Detail	n	n	n	Neg
Auto. Information	n	Pos	n	n
Space Perception	n	n	n	Pos
Electronic Info.	Pos	n	n	n
Arithmetic Reasoning	n	n	n	Neg
Shop Information	n	Neg	Neg	n
AFQT Percentile	n	n	Neg	n
AFQT Group	Neg	n	n	n
Entry Paygrade	n	Pos	n	n
SCREEN Score	Pos	n	n	n
Dependents (number)	Pos	n	Neg	Neg

Note  
Pos means the coefficient was positive.  
Neg means the coefficient was negative.  
'n' means the variable was not selected.

For FNs, see Table XIX, entry age entered the regression only for blacks, and it has a negative coefficient. Education level is selected for two groups, the 'other' male race category and white women, and for both, the sign is positive: higher education level implies fewer undesirable behaviours. There are a variety of ASVAB subtests selected with differing signs, and it is interesting to note that for three of the four groups the number of dependents entered the regression. For white males, having more dependents suggest fewer negative behaviours, while for the 'other' races and white females, having more dependents is associated with more negative behaviours.





TABLE XX  
Stepwise Regression for AT on Badguy

Variable	White	MALE Black	Other	FEMALE White
Entry Age: years	Pos	n	n	Pcs
Marital Status	Neg	n	n	Pcs
Highest Education	Pos	n	n	n
Auto. Information	n	Pos	Neg	n
Electronics Scale	n	n	n	Neg
Math. Knowledge	n	Neg	Pos	n
Electronic Inf.	n	n	Neg	n
Arithmetic Reasoning	n	Pos	n	n
Combat Scale	n	n	n	Pcs
AFQT Percentile	n	Pos	n	n
AFQT Group	Neg	Neg	n	n
Entry Paygrade	Neg	Neg	n	Neg
SCREEN Score	Pos	n	Pos	n
Dependents (number)	n	n	n	Neg

Note  
Pos means the coefficient was positive.  
Neg means the coefficient was negative.  
'n' means the variable was not selected.

The final stepwise table, Table XX, shows the selected predictors for AT groupings on the badguy scale. The most consistent subtest finding across groupings is the entry paygrade, which has a negative sign. This variable is selected in three groupings and implies that the higher the entry pay grade the more likely are negative type behaviours.

#### 4. Validity Estimates

Shown in the next series of tables are double cross-validation coefficients by rating, grouping and randomly selected sample. They are based on forming predictor equations from the stepwise procedures for each individual group. Validities for the "men all" category were the result of forming regression equations on all predictors which had been independently selected by male race groupings. The average validities given were calculated using Fisher's transformations for determining average weighted correlation coefficients (see McNemar, 1963, pp. 139-140).



# a. Length of Service

The length of service validities by individual sample are shown in Table XXI. All of them are significant except for the 'other' male race grouping, in both the PN and AT ratings, and the women in the AT rating. Most of the validities are greater than .20, but only one (AT blacks in Sample 1) is in excess of .40.

TABLE XXI  
Length of Service Validities by Rating and Sample

		Sample 1			Sample 2		
RATING		n	r	p <	n	r	p <
MEN	SH All	1016	.2748	.0001	1022	.2806	.0001
	White	671	.1893	.0001	635	.2330	.0001
	Black	262	.3375	.0001	296	.2581	.0001
	Cther	91	.3053	.0033	78	.3640	.0011
MEN	FN All	817	.2731	.0001	783	.2785	.0001
	White	606	.2881	.0001	620	.2894	.0001
	Black	158	.3519	.0001	125	.2963	.0008
	Cther	66	.0546	.6634	46	.1294	.3919
WOMEN	White	241	.2060	.0013	238	.2939	.0001
MEN	AT All	1824	.2530	.0001	1799	.2803	.0001
	White	1676	.2617	.0001	1678	.2856	.0001
	Black	91	.4227	.0001	85	.3338	.0018
	Other	58	.2393	.0705	52	.2125	.1304
WCMEN	White	124	.1219	.1771	116	.2399	.0095

# b. Goodguy Criterion

For each rating as shown in Table XXII, some of the validities by groups are statistically insignificant. The overall magnitude of these validities, compared to those for the length of service criterion, are smaller. The maximum validity is .378, while a number of them are less than .10.



TABLE XXII  
Goodguy Validities by Rating and Sample

RATING		Sample 1			Sample 2		
		n	r	p <	n	r	p <
MEN	SH All	1016	.1052	.0008	1004	.1373	.0001
	White	681	.1586	.0001	649	.2176	.0001
	Black	262	.1268	.0403	296	.1593	.0060
	Other	83	.3673	.0006	73	.3916	.0006
MEN	FN All	817	.0914	.0090	783	.0666	.0627
	White	606	.1695	.0001	620	.1464	.0003
	Black	160	.1579	.0462	128	.1179	.1852
	Other	66	.0987	.4306	46	.2631	.0773
WOMEN	White	241	.1752	.0064	238	.1799	.0054
MEN	AT All	1824	.0421	.0723	1799	.0339	.1503
	White	1712	.0895	.0002	1688	.0303	.2128
	Black	91	.3046	.0033	85	.3503	.0010
	Other	58	.2577	.0508	52	.3464	.0119
WOMEN	White	125	.0004	.9969	118	.0514	.5807

TABLE XXIII  
Badguy Validities by Rating and Sample

RATING		Sample 1			Sample 2		
		n	r	p <	n	r	p <
MEN	SH All	1016	.1713	.0001	1004	.2062	.0001
	White	671	.1967	.0001	635	.2589	.0001
	Black	270	.1178	.0531	302	.1890	.0010
	Other	91	.3652	.0004	78	.3254	.0037
MEN	PN All	817	.0963	.0059	783	.0980	.0061
	White	606	.1452	.0003	620	.1174	.0034
	Black	160	.2852	.0003	128	.2049	.0204
	Other	66	.1102	.3784	46	.1717	.2538
WOMEN	White	241	.1815	.0047	238	.1896	.0033
MEN	AT All	1824	.2293	.0001	1799	.1999	.0001
	White	1676	.2513	.0001	1664	.2086	.0001
	Black	91	.2741	.0086	85	.3670	.0006
	Other	58	.3728	.0040	52	.4464	.0009
WOMEN	White	125	.2688	.0024	118	.2400	.0089



### c. Badguy Criterion

For this criterion, validities seem to be higher than for the good guy criterion, as shown in Table XXIII. Only four of the 28 sample validities are insignificant at the .01 level of significance. The highest validity of any presented so far (.4464) occurs for one of the 'other' race samples (for ATs).

### 5. Average Validities

Using the Fisher method, average validities were calculated from the validities just presented and these are shown in the next two tables. Table XXIV, shows the average

TABLE XXIV  
Average Validities by Group and Criterion

		CRITERION		
RATING		ICS	Goodguy	Badguy
MEN	SH All	.2777	.1212	.1879
	White	.2107	.1876	.2272
	Black	.2959	.1441	.1556
	Cther	.3327	.3787	.3470
MEN	FN All	.2757	.0793	.0971
	White	.2888	.1578	.1312
	Black	.3277	.1412	.2500
	Cther	.0852	.1669	.1354
WOMEN	White	.2502	.1775	.1855
MEN	AT All	.2666	.1380	.2148
	White	.2737	.0602	.2301
	Black	.3801	.3268	.3197
	Other	.2262	.3002	.4082
WOMEN	White	.1796	.0252	.2549

validity across each of the samples by racial groupings and ratings. The largest average validity occurs for the AT rating (.41) in the 'other' racial group on the bad guy criterion. The second highest validity is also for an AT rating (.38); it is for the black racial group.





Table XXV, lists grand average validities for men, for rating by criterion. For length of service, all three rating average validities are in excess of .25, with a slightly increasing trend in size of coefficient as the

TABLE XXV  
Validities for Males by Rating and Criterion

RATING	CRITERION		
	ICS	Goodguy	Badguy
SH	.2515	.2046	.2277
FN	.2707	.1562	.1517
AT	.2762	.0867	.2450

rating complexity increases. For the goodguy scale, the rank order of validities by magnitude is reversed: validities decrease with rating complexity. The average validity for ATs on this criterion is particularly small. There is no consistent ranking by complexity for the other criterion, badguy. The PNs validity remains about the same as for the goodguy scale, as does the SH validity. The average validity for the ATs on this scale has increased considerably, up to .245.

### C. ESTIMATING CUT-OFFS

The method for estimating the cut-offs was described in the previous chapter. However, to illustrate the method, the calculation of the first few values in Figure 5.1 is given here. It should be noted that most of the figures in this section have two or more graphs drawn on them. This is done in the interests of economy rather than to imply they are related: each graph is based on a separate predictor criterion relationship.



SB Men on LOS Criterion  
Race Blind Selection  
Across ALL Men

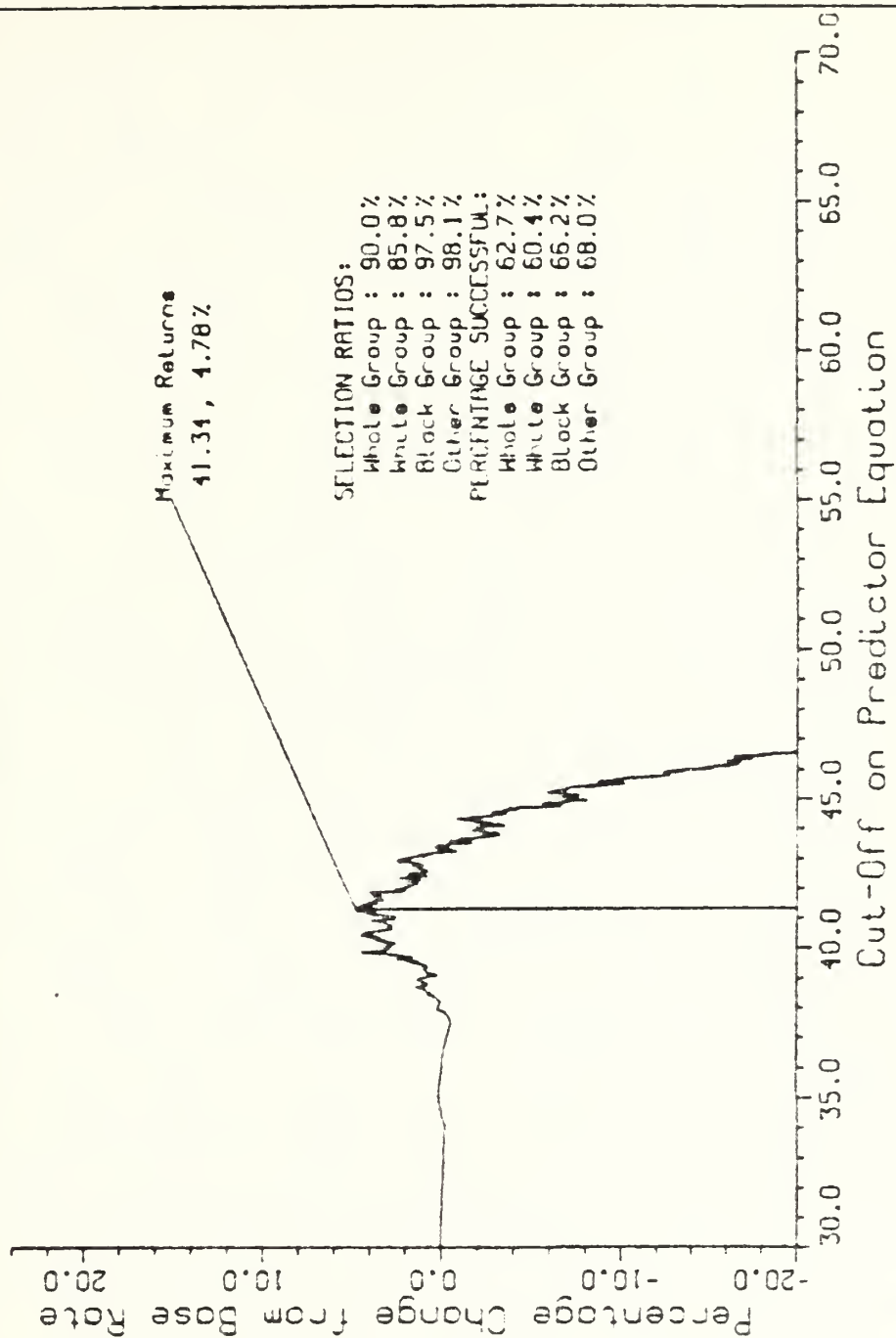


Figure 5.1 Race Blind Selection for SB on LOS.



The figures give several pieces of information, the most important of which is the line representing percentage change from the base rate, for various potential predictor cutting scores. For Figure 5.1, the base rate is determined as follows. Of the 2,020 male SH personnel 1,235 served four years or more, while 785 served for less than four years. Converting these values to probabilities gives a 61.14% chance for a male SH meeting the criterion of completing four years or more years of service, and 38.86% chance of failing it. Using the utility values given in Table IV and equation 4.1 we now calculate the base rate as the sum of the products of the chances of an outcome by its utility. The SH length of service base rate is 6,693.39. As the reader will recall, this is the value for selection set so low that all personnel are accepted. The first potential cutting score is the smallest predictor score from the sample of 2020. This score is 34.1208 and occurs for an SH who passed the four year criterion. With the cutting score set at this value, there are 1,234 sailors out of 2,020 who are successful and who would be correctly predicted as successful based on this predictive relationship. One sailor out of 2,020 would have been predicted to have failed the criterion for this cut-off, while 785 would have been incorrectly predicted to pass. The numbers are converted to probabilities to give 61.09%, .05% and 38.86%, respectively. These three probabilities have utility values of 19,260, -9360 and -13077. Summing across the products of probabilities and utilities gives a total value of 6679.23. Therefore, the return over base rate for a cut-off at 34.1208 is a -0.21% change. There is a slightly negative return over base rate for this cutting score. On Figure 5.1 the values 34.01208 and -0.21 are plotted as the first cut-off point and its respective return. The next highest predictor score, 34.4115, is chosen. This happens to be for



a sailor who fails to meet the criterion. At a cutting score of 34.4115, the probabilities and their respective utilities are: 61.09% and 19,260; .05% and -9360; .05% and 13077; and, 38.81% and -13077. Summing the product of these values gives a total utility of 6685.70, which is a -.11% decline over base rate. Therefore the next point plotted is 34.4155 and -.11. This process is repeated for all 2020 predictor scores keeping track of the value of the maximum return over base rate and its respective cutting score. Note in Figure 5.1 that values of base rate return which are less than -20.0% are not plotted.

Also shown in the figures are two other pieces of information. The selection ratio is defined as the percentage/proportion of personnel selected out of the total who apply. The values shown in the figures are selection ratios at the cutting score which maximise total return over base rate. On each figure selection ratio is shown either by race (for men) or rating (for women). The other statistic is the criterion proportions for those who are predicted to be successful. For Length of Service, the percentages who serve for at least four years are given, while for the other criteria the percentages by criterion categories are shown. This latter statistic gives an idea as to the expected performance of the group selected for this cutting score, while the selection ratio indicates how the selection device will impact the applicant group at this score.

#### 1. LOS\_Criterion

As can be seen from Figure 5.1, the optimum cut-off score for the SH rating produces almost a 5% increase over the base rate utility. The predictor equation here is for male SHs based on all those variables selected for men in Table XII. The Figure shows the selection ratios and success percentages for the optimum cut-off score by race.





At this cut-off, white SHs have the smallest selection ratio of any race, but they also have the smallest percentage of success for those who would be selected. The majority of the 'black' and 'other' racial groups are selected and the highest percentages are successful in these groups.

Shown in Figure 5.2 are the cutting scores derived for race specific predictor equations. The best expected return is for the 'other' group (28.8%), followed by whites (8.9%), and blacks (1.7%). Set at these respective cut-off levels, 85% of the 'other' group are selected with about 76% of them serving beyond four years. For whites, 95% would be selected, with 59% successful. For blacks, virtually all (99.5%) would be selected, with a 67% success rate.

In comparing these figures for SH on LOS (Figures 5.1 and 5.2), several trends are apparent. The 'race-blind' selection seems to be most severe, in terms of selection ratio, on the white group. When the white specific predictor equation is employed, more whites are selected, for a slight decline (about 1.5%) in the percentage success. For the black group, a race specific predictor also improves the selection ratio, with a slight decline in the success rate. However for the 'other' race group, the race specific predictor equation markedly reduces the selection rate (down by about 13%), but boosts the success percentage by almost the same amount.

Figures 5.3 and 5.4 show LOS results for the PN rating. Race blind selection produces about a 6% improvement over base rate. As for SHs, the race blind predictor is most severe on the white group in terms of selection ratio. However, for those whites selected, their success percentage is better than the black PNs. While the blacks are the least successful for this predictor equation, about 97% of them are selected. At the cut-off level for this race blind equation, 100% of the 'other' racial group is selected, with about 76% of them being successful.



SH Men on LOS Criterion  
Race Specific Selection  
For ALL SH Men

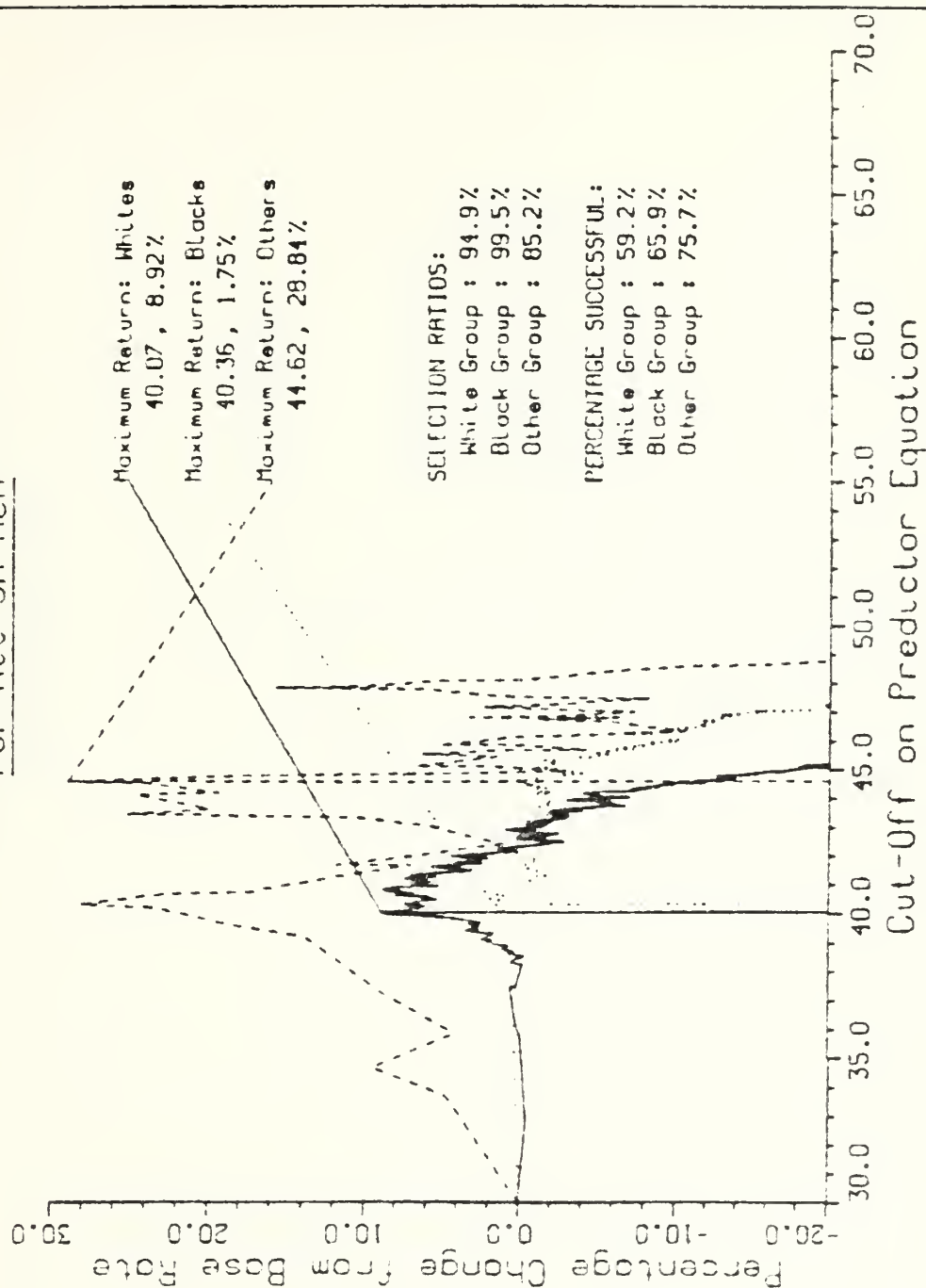


Figure 5.2 Race Specific Selection for SH on LOS.



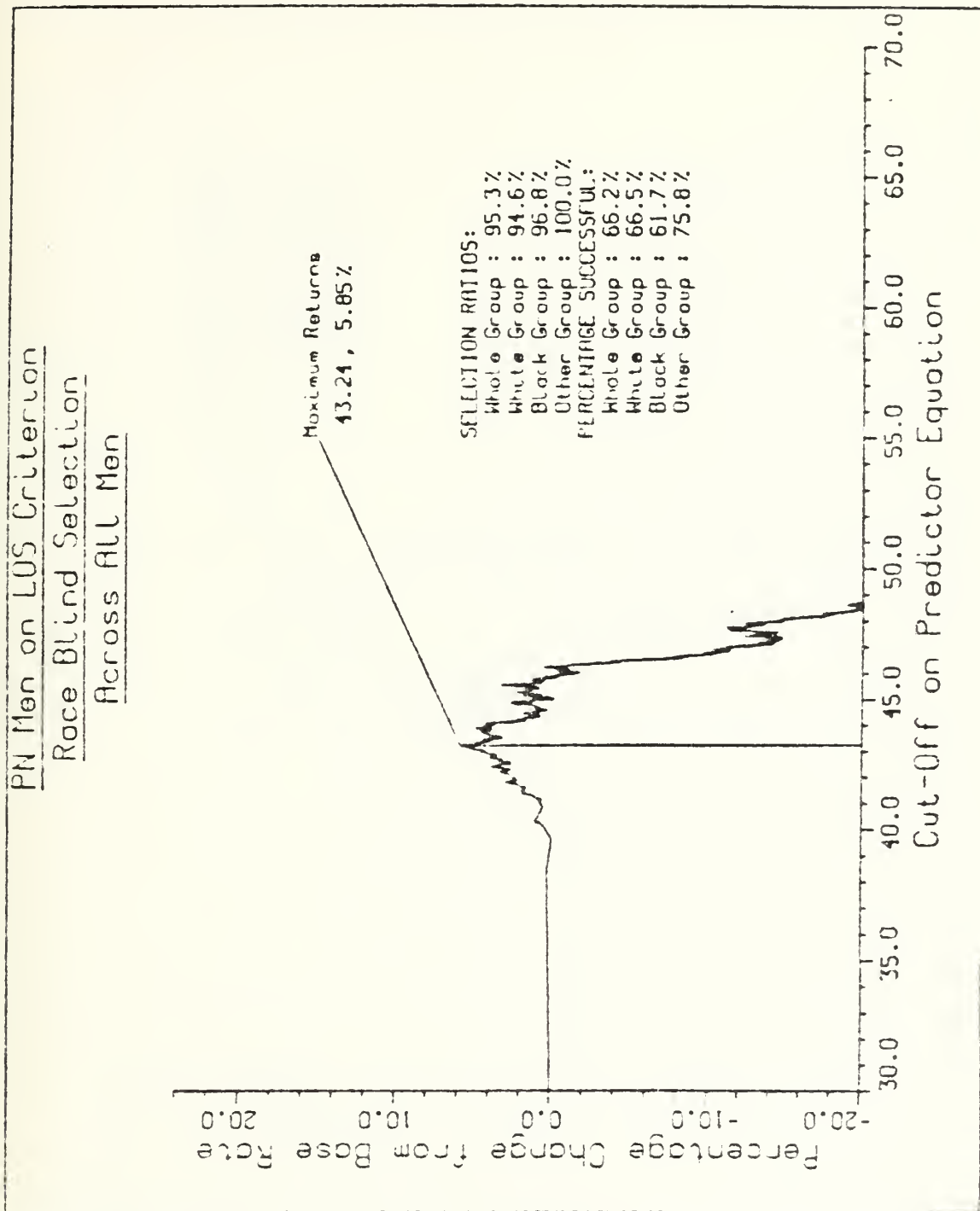


Figure 5.3 Race Blind Selection for PM on LOS.



PN Men on LOS Criterion  
Race Specific Selection  
For ALL PN Men

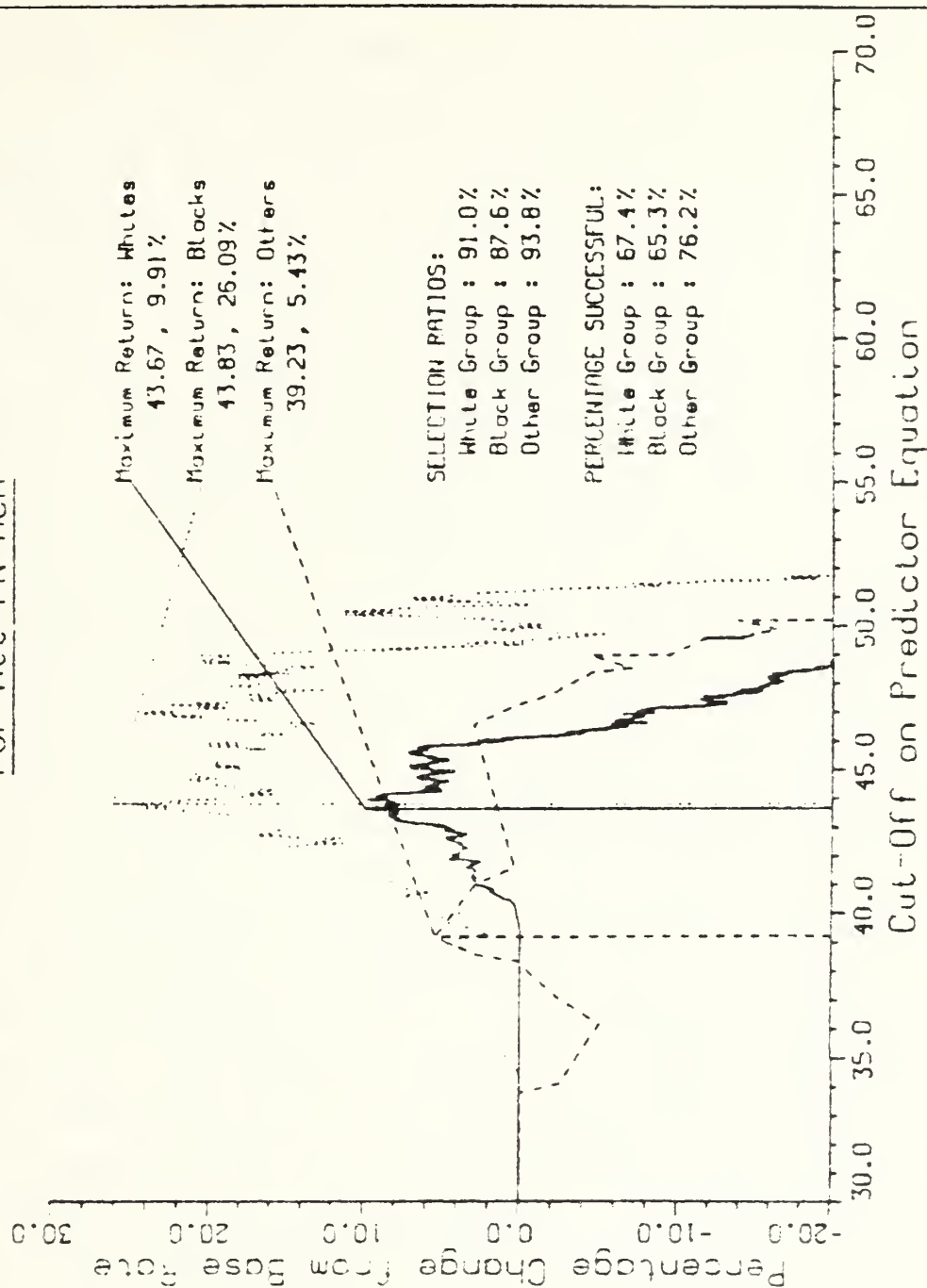


Figure 5.4 Race Specific Selection for PN on LOS.





The return for individual race selection equations (Figure 5.4) is greater than from the race blind selection for each race. Blacks show the biggest improvement, with a reduction in their selection rate, down from 97%, but an improvement in their success percentage. Next come whites whose selection ratio has also been reduced but their success percentage improved. This is followed by the 'other' racial group, who are now selected at a rate of about 94%, with a slight increase in overall success percentage. Therefore, for all racial groups, race specific predictors have lead to a decline in selection rate, but improvements in overall utility and success percentages.

As can be seen in Figures 5.5 and 5.6, the same trends are not true for ATs on LOS. Race blind selection, lead to about a 3% improvement on base rate, with all races being fairly close together on selection ratios and success percentages. The white race is marginally ahead on both of these indices. In Figure 5.6, about the same values apply for whites on race specific selection. However, the race specific equations for blacks and for the 'other' racial group have determined optimum cutting scores for which all of the cases would be rejected. That is, no one is selected and thus no one is successful. This result may have been expected for AT 'others' because of the insignificant validity coefficient for this group (see Table XXI). Low validity suggests that any optimum cut-off value is likely to be spurious rather than meaningful. However, Table XXI shows a highly significant validity for blacks. Therefore deriving an optimum cut-off which rejects everyone is certainly not expected.

Shown in Figure 5.7 are the LOS results for white women PNs and ATs. Both optimum cut-offs have improved the base rate figure (24% for PN and 36% for AT). While the selection ratios are lower than their male counterparts, so



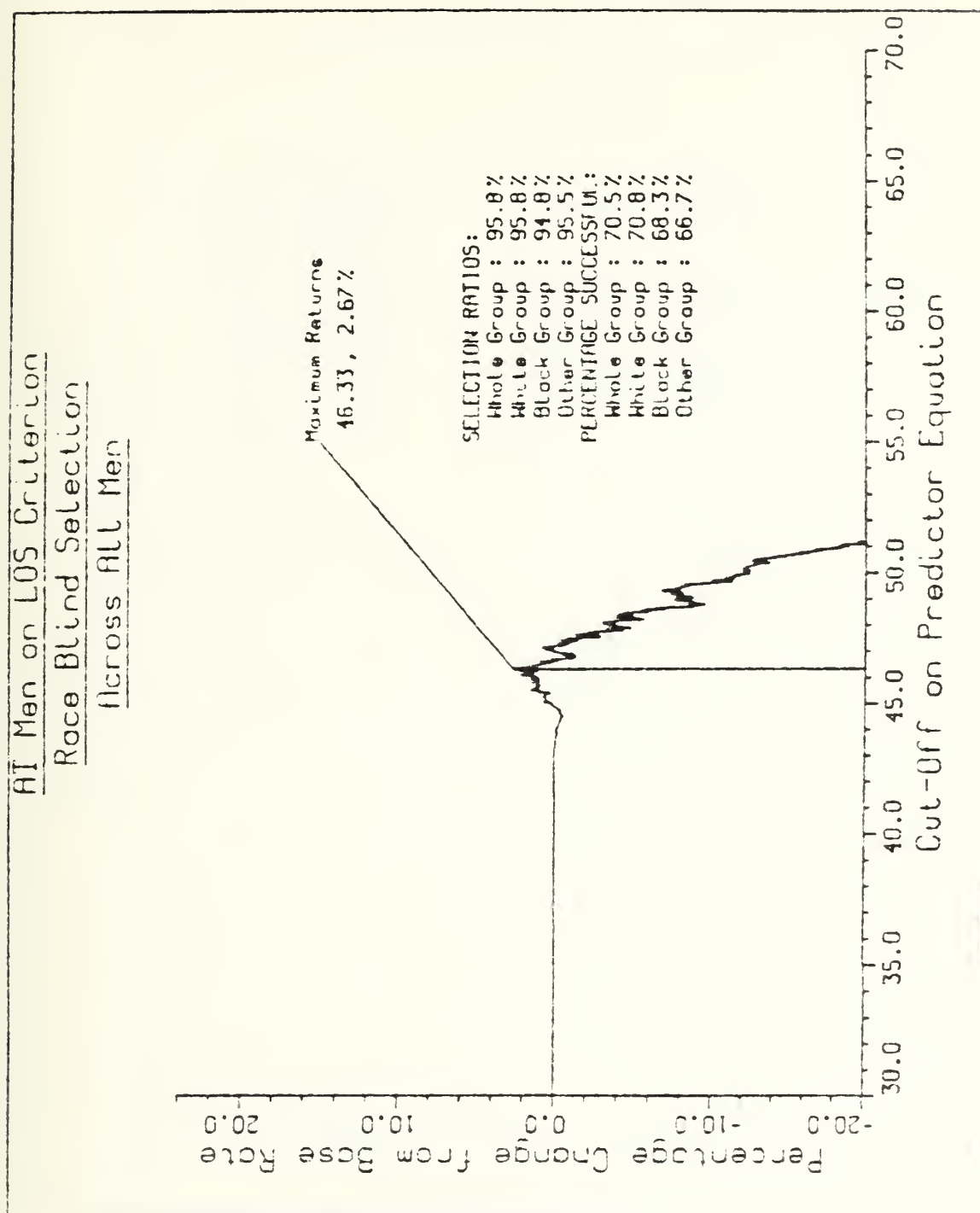


Figure 5.5 Race Blind Selection for AT on LOS.



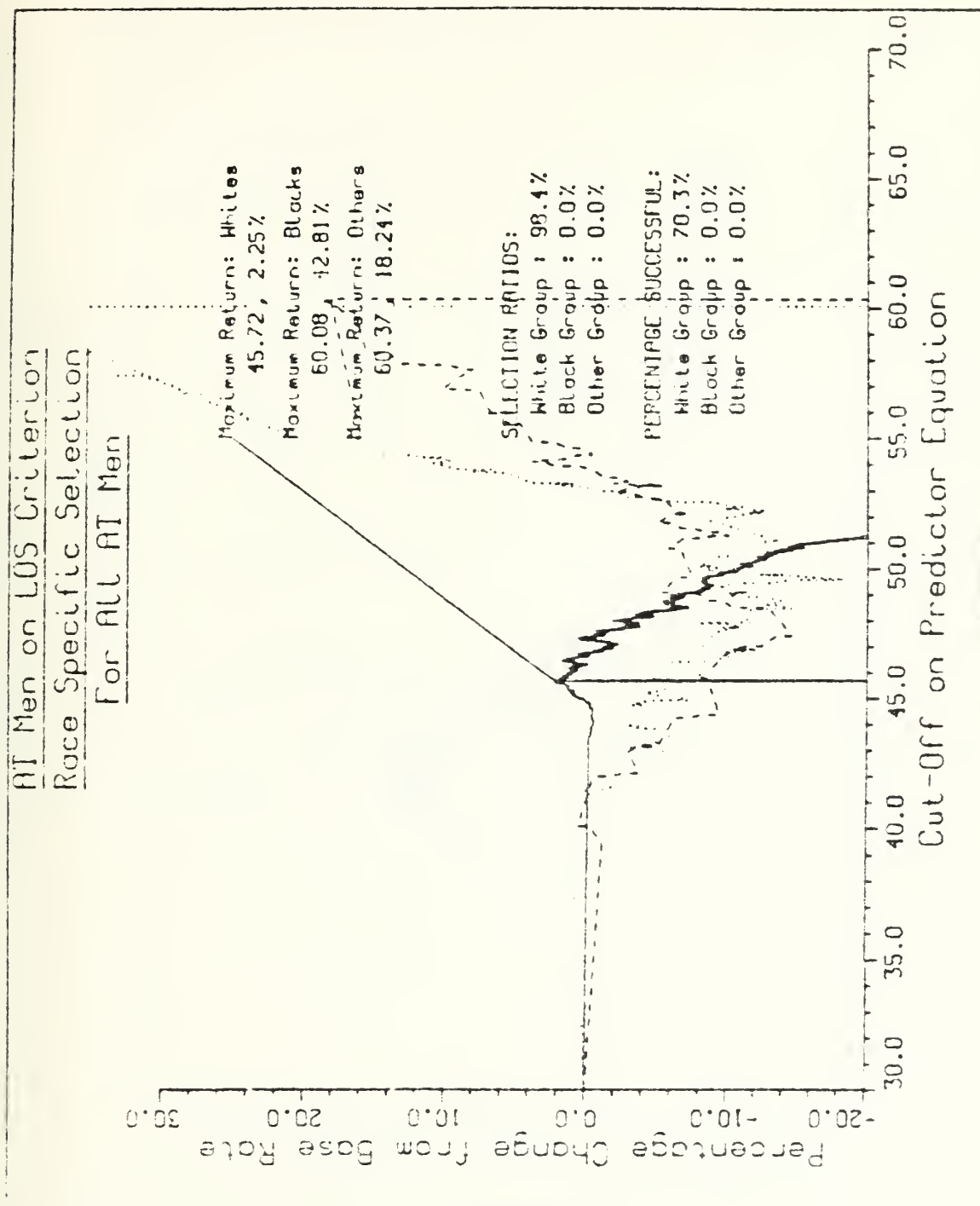


Figure 5.6 Race Specific Selection for AT on LOS.



White Women on LOS Criterion  
Rating Specific Selection  
For PN & AT Women

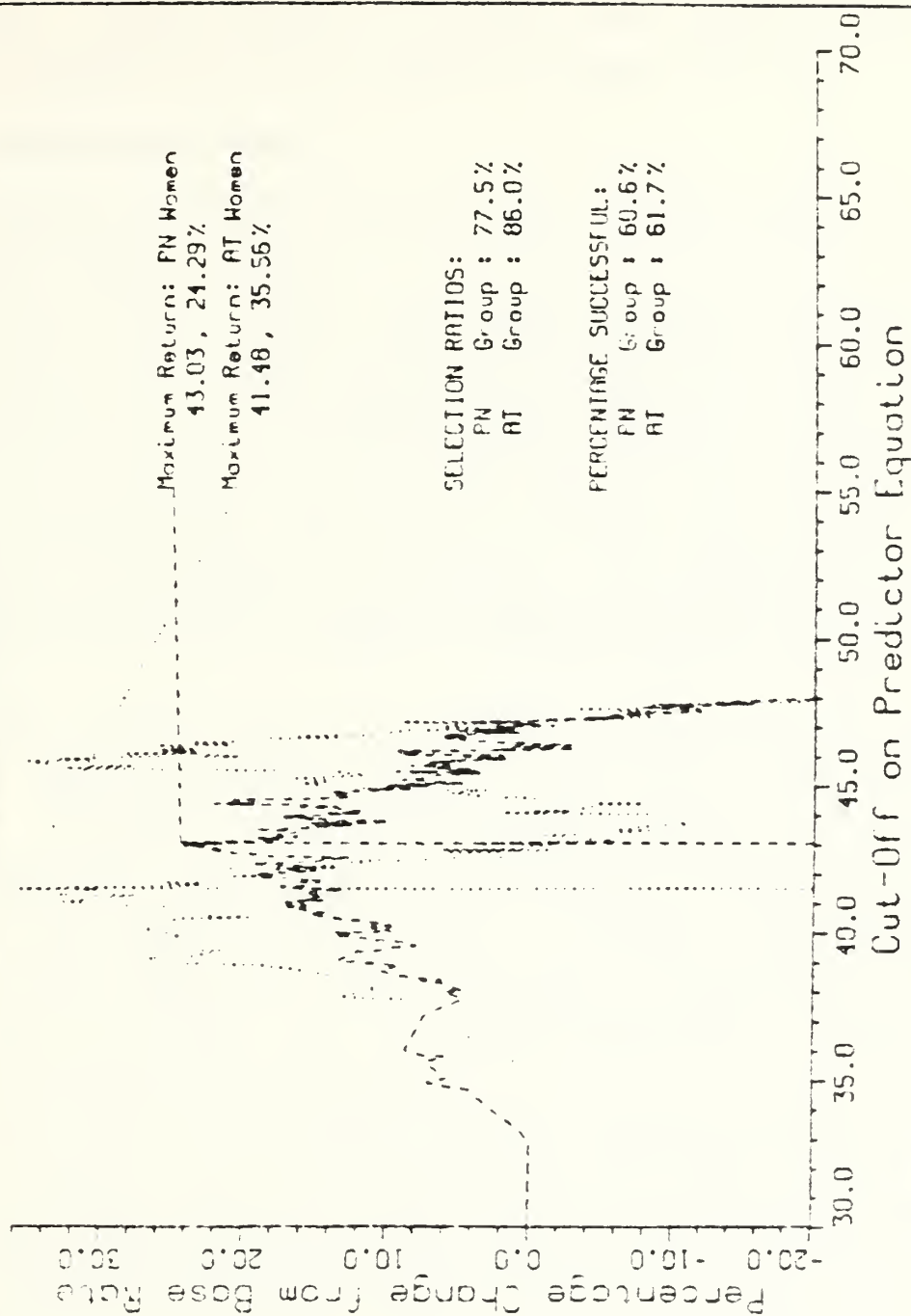


Figure 5.7 Rating Selection for PN & AT Women on LOS.





too are their success percentages. This is not so surprising, since Tables X and XI show women have the smallest average LOS of all groups in these ratings.

## 2. Goodguy\_Criterion

Shown in Figures 5.8 to 5.14, are the results of the analyses on this criterion.

For the SH rating, race blind selection leads to a selection ratio for whites that is the smallest of all three races. However, as can be seen from Figure 5.8, the optimum cut-off yeilds a return of just over 2%. For race specific selection (see Figure 5.9), the returns for whites and 'other' races are well over 30%, but in this case, only 65% of the white group would be selected. The selection ratios are reduced for all races, compared with race blind selection.

The returns for the PN rating on the goodguy scale, follow a similar pattern as can be seen from Figures 5.10 and 5.11. However, for this rating, blacks in the race blind selection, have the smallest selection ratio, but they also show the largest return (42%). Indeed, race specific selection has improved their position in selection ratio terms from the lowest for race blind selection to the mid-point on race specific selection.

For ATs on the goodguy scale, race blind selection does not produce any positive return over base rate (see Figure 5.12). The return for race specific selection (Figure 5.13), is substantial for blacks and 'others' (38% and 78%, respectively) but a little more than 1% for whites. For the 'other' race group, this high return is achieved with a selection rate of about 61%. For female PN and AT on the goodguy criterion, see Figure 5.14, the returns are almost 600%. The cut-off for AT seems unrealistic, since only 14% are selected, whereas for PN the selection rate is 75% means that a reasonable proportion will be selected.



SH Men on GOODGUY Criterion  
Race Blind Selection  
Across ALL Men

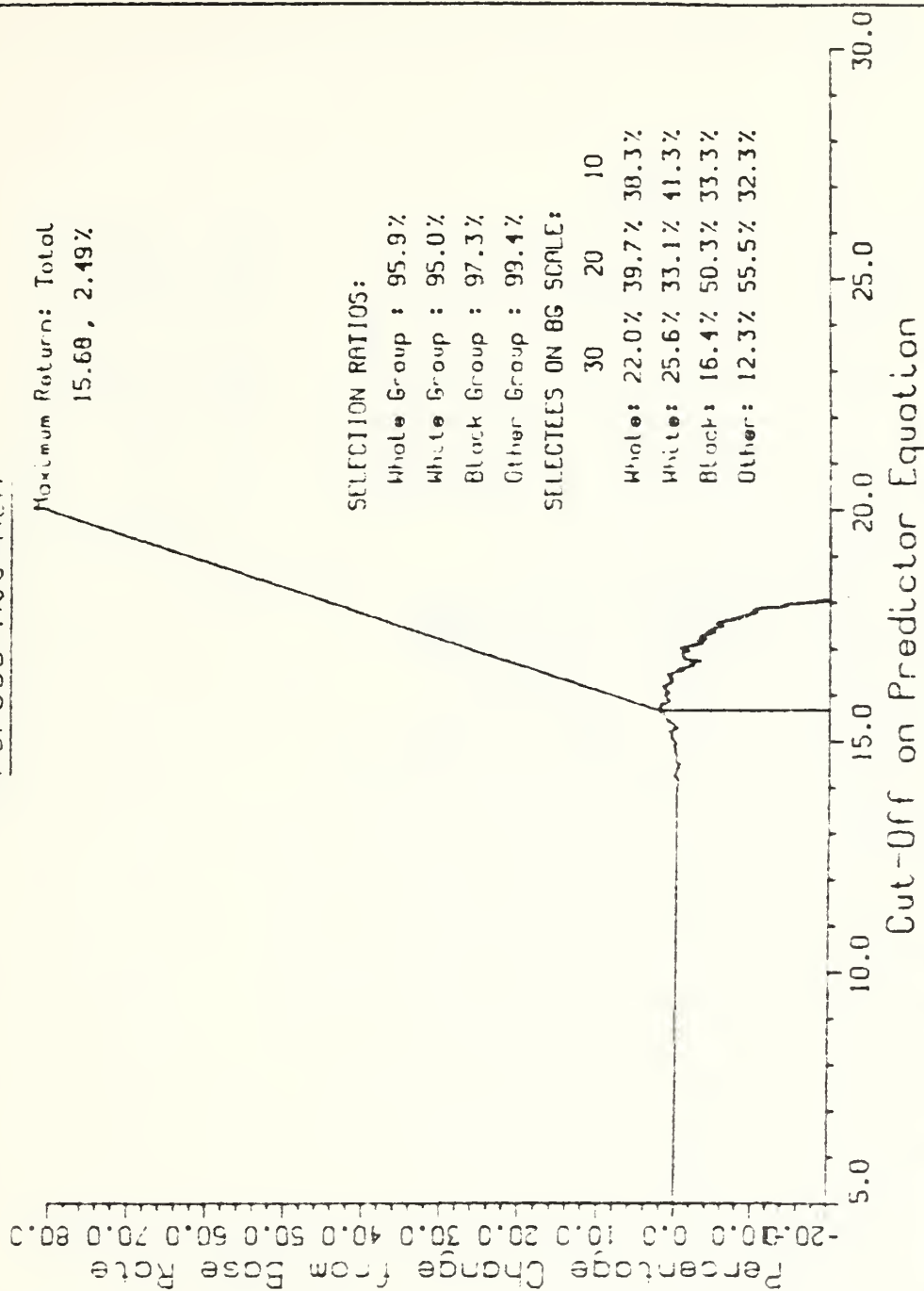


Figure 5.8 Race Blind Selection for SH on Goodguy.



SH Men on GOODGUY Criterion  
Race Specific Selection  
For ALL SH Men

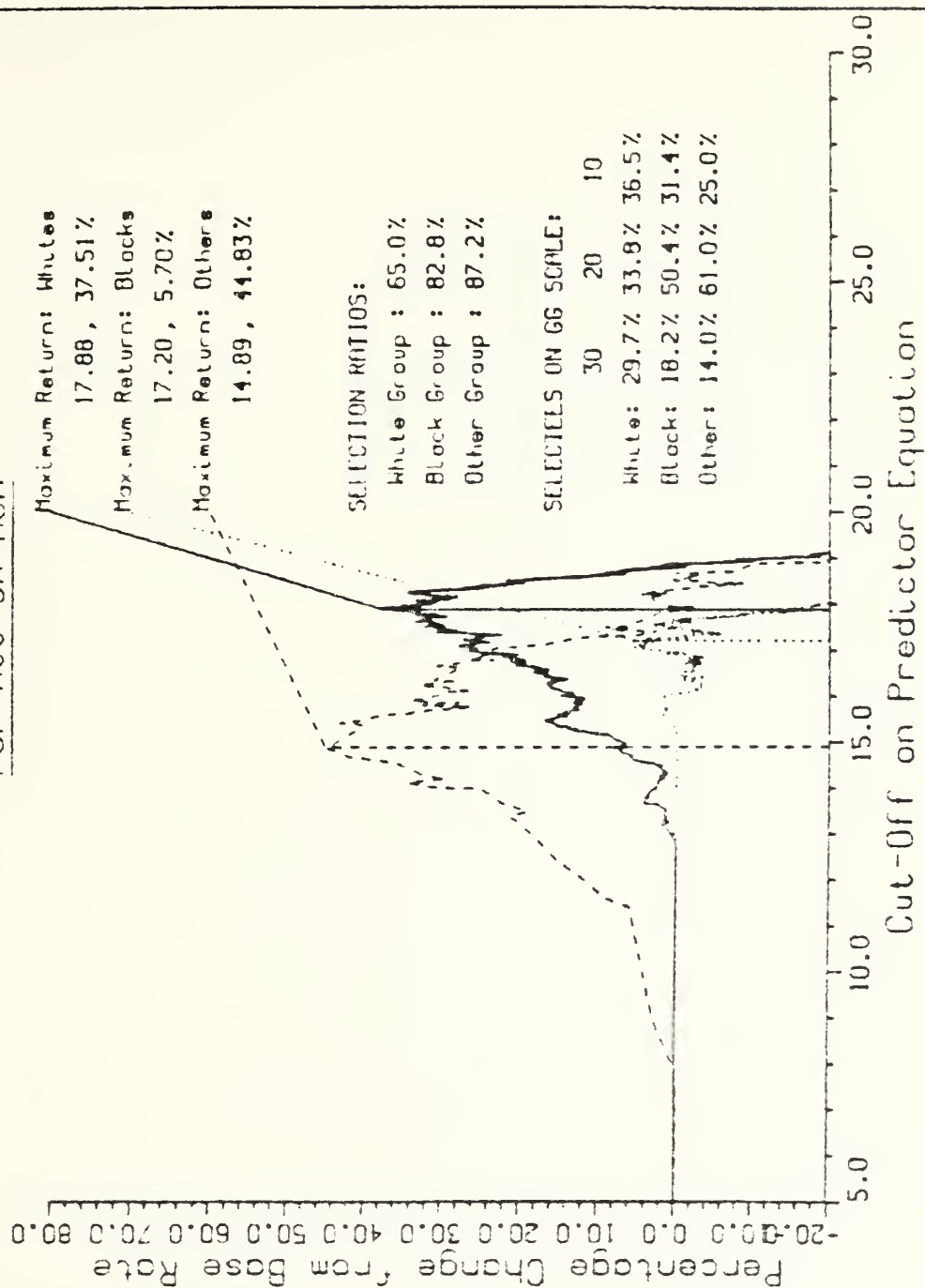


Figure 5.9 Race Specific Selection for SH on Goodguy.



PN Men on GOODGUY Criterion  
Race Blind Selection  
Across All Men

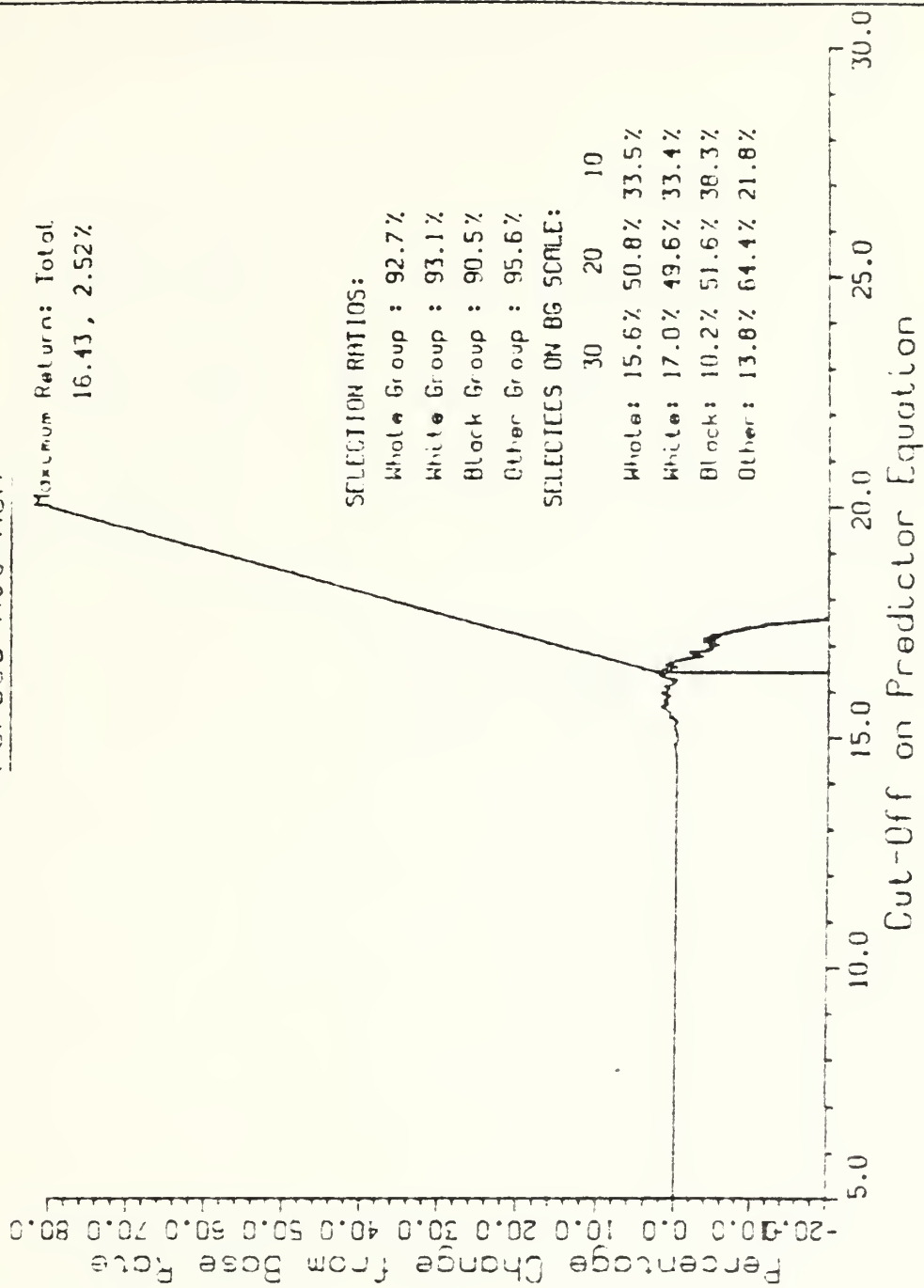


Figure 5.10 Race Blind Selection for PN on Goodguy.





PN Men on GOODGUY Criterion  
Race Specific Selection  
For ALL PN Men

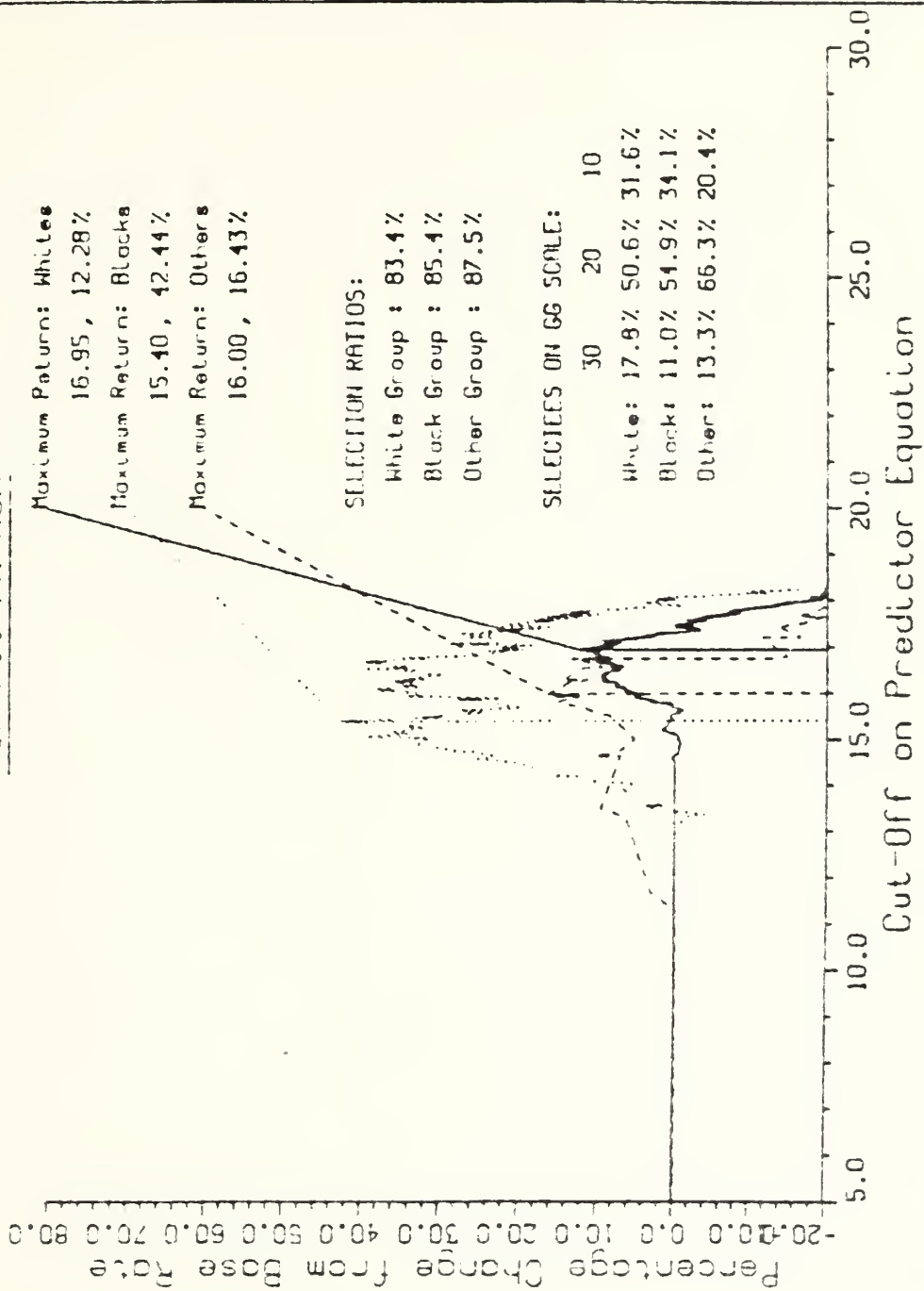


Figure 5.11 Race Specific Selection for PN on Goodguy.



AT Men on GOODGUY Criterion  
Race Blind Selection  
Across ALL Men

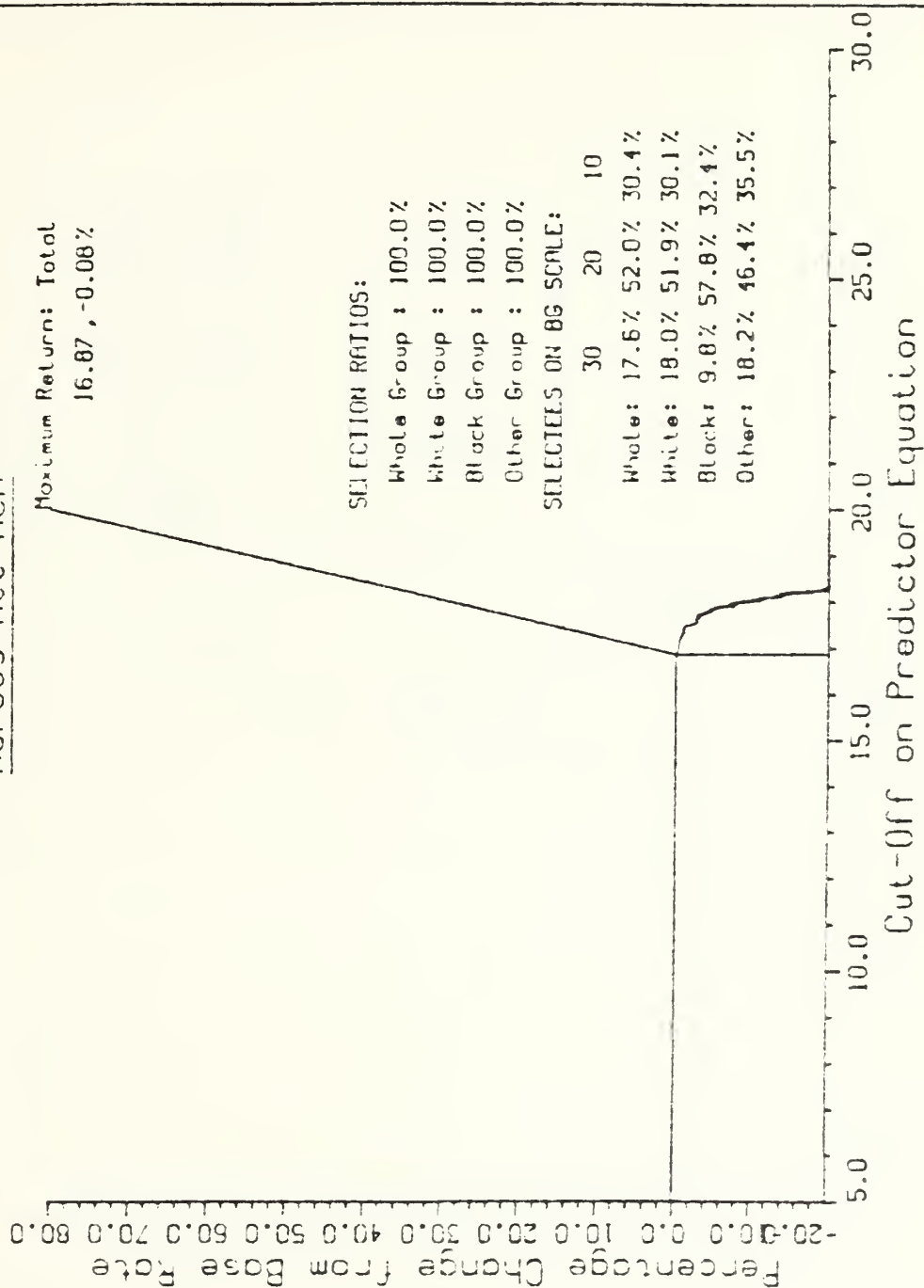


Figure 5.12 Race Blind Selection for AT on Goodguy.



AT Men on GOODGUY Criterion  
Race Specific Selection  
For All AT Men

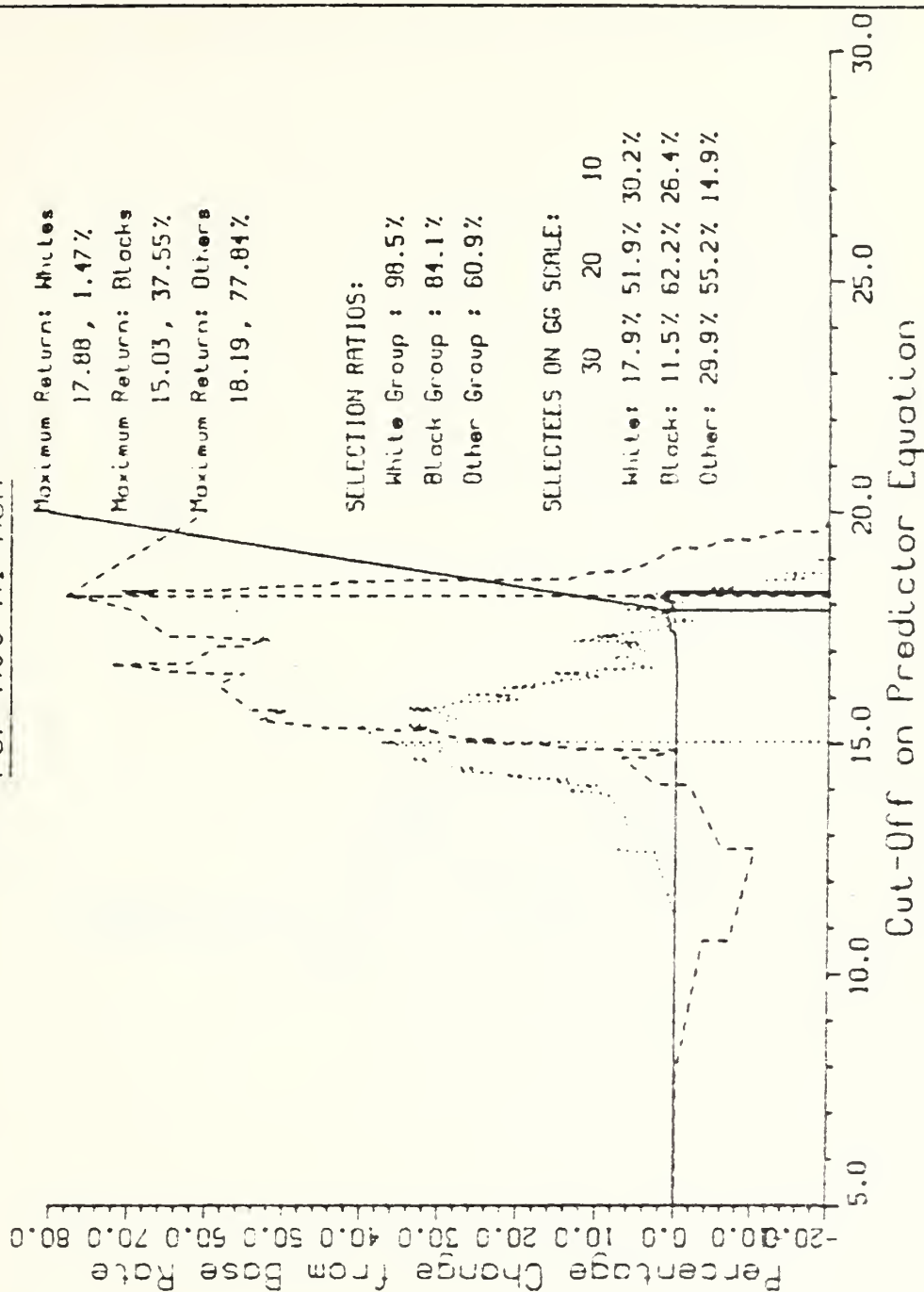


Figure 5.13 Race Specific Selection for AT on Goodguy.



# Women on GOODGUY Criterion

## Race Specific Selection

### For PN & AT White Women

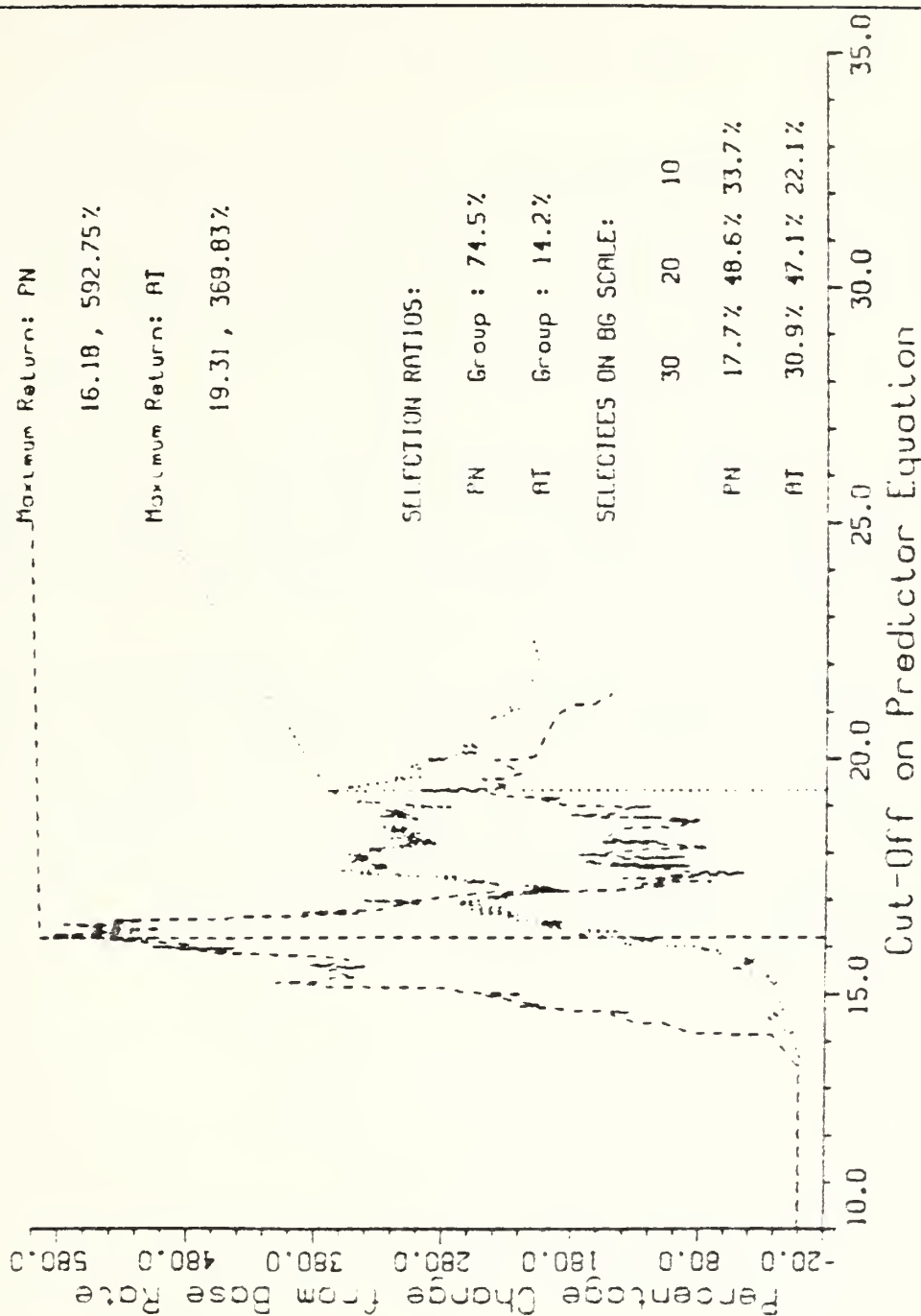


Figure 5.14 Rating Selection for PN & AT Women on Goodguy.





### 3. Badguy\_Criterion

The seven Figures 5.15 to 5.21, show the results for this criterion.

Race blind selection for male SHs, see Figure 5.15, shows about a 3% improvement over base rate. White men are the race which have the lowest selection ratio in race blind selection. Moderate improvement for whites and the 'other' racial group occur for race specific prediction (Figure 5.16).

For PN, see Figures 5.17 and 5.18, there is virtually no effective return using the badguy criterion. While the 'other' racial group shows only about a 6% improvement over base rate, the selection ratio of 98.2% is extremely high.

As can be seen in Figures 5.19 and 5.20, for AT men no selection device has been found that produces an improvement over the base rate.

For women on this criterion, Figure 5.21 shows a positive (AT) and a negative (PN) return. The AT return is difficult to interpret and results in a 99% selection ratio.



SH Men on BADGUY Criterion  
 Race Blind Selection  
 Across All Men

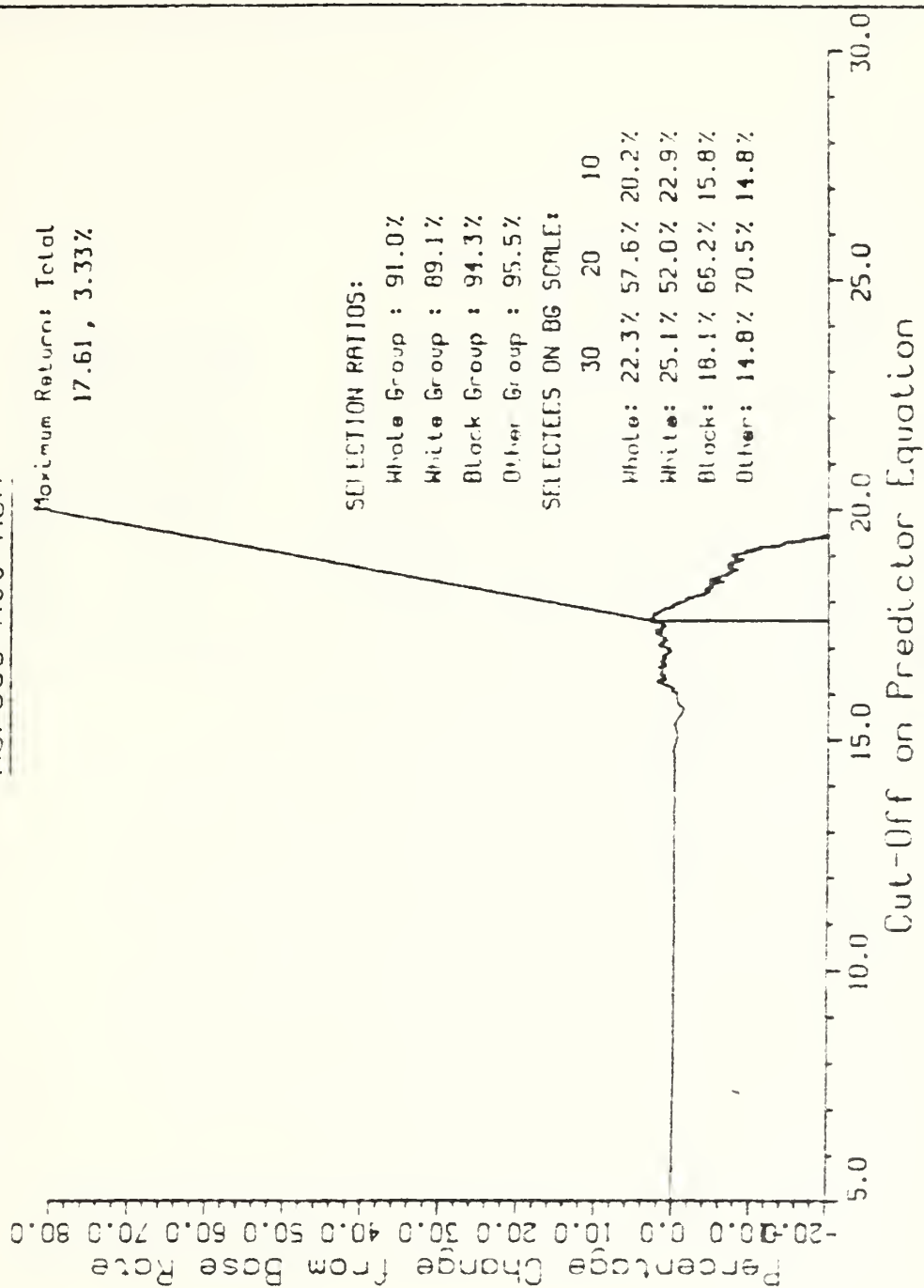


Figure 5.15 Race Blind Selection for SH on Badguy.



# SH Men on BADGUY Criterion Race Specific Selection For ALL SH Men

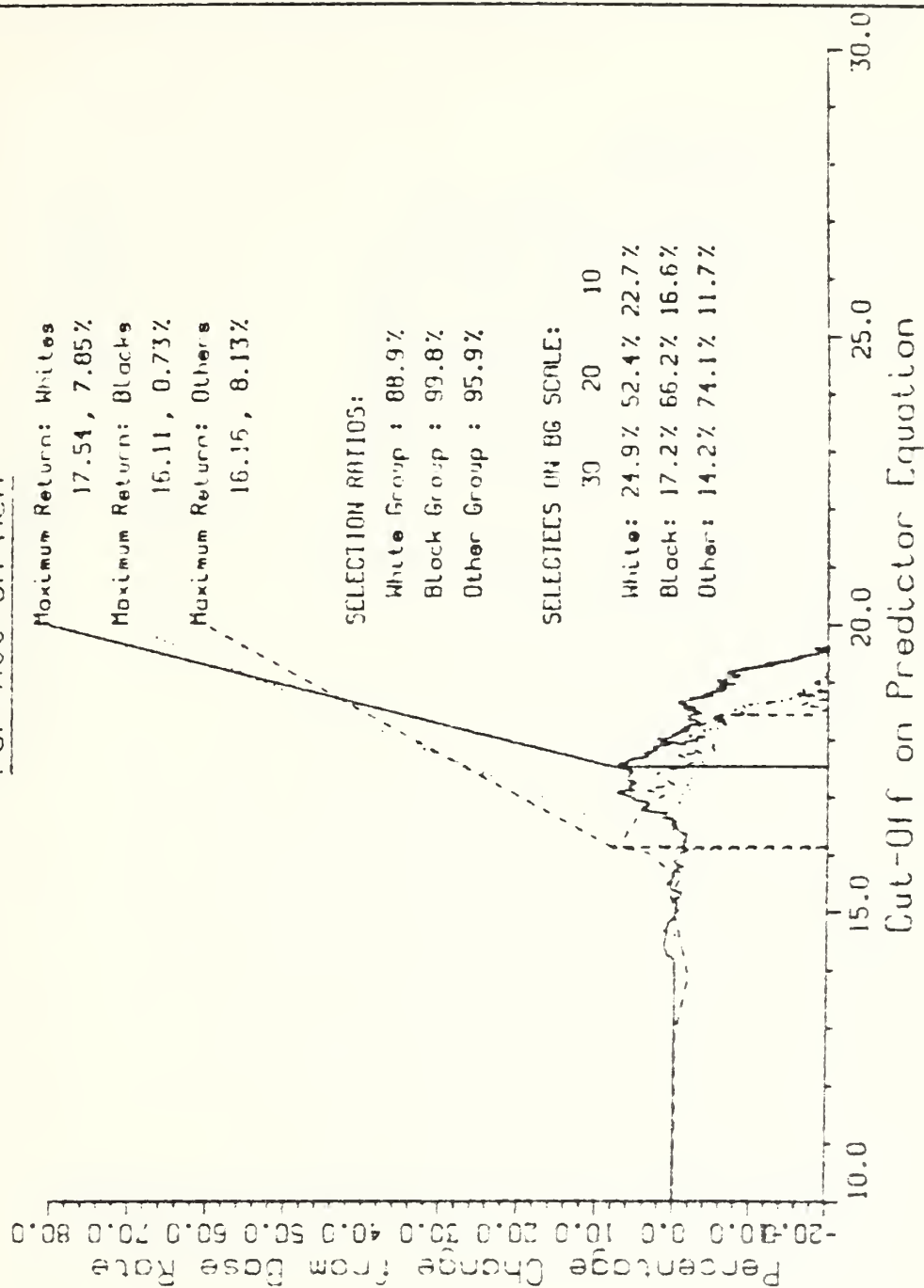


Figure 5.16 Race Specific Selection for SH on Badguy.



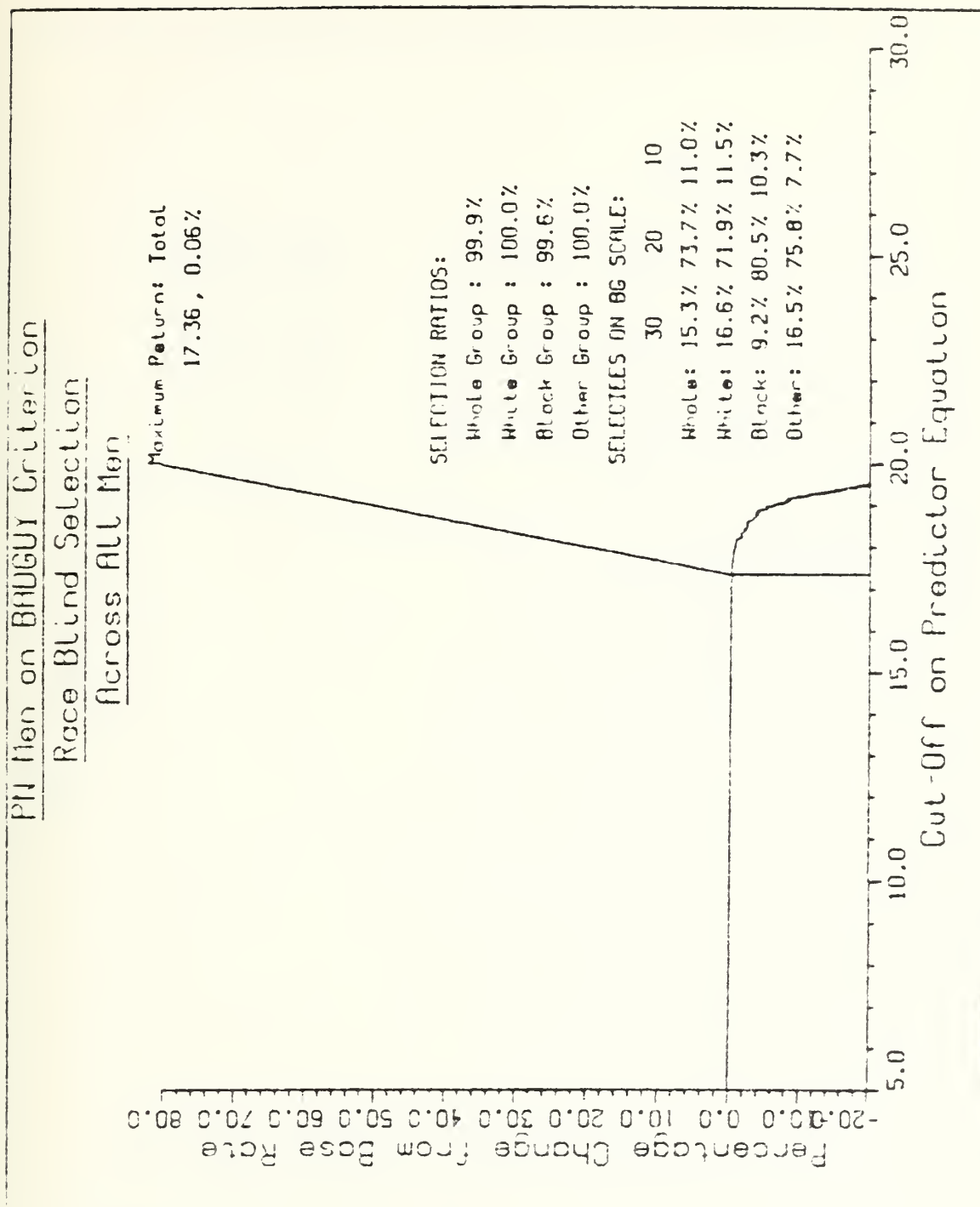


Figure 5.17 Race Blind Selection for PN on Badguy.





PN Men on BADGUY Criterion  
Race Specific Selection  
For ALL PN Men

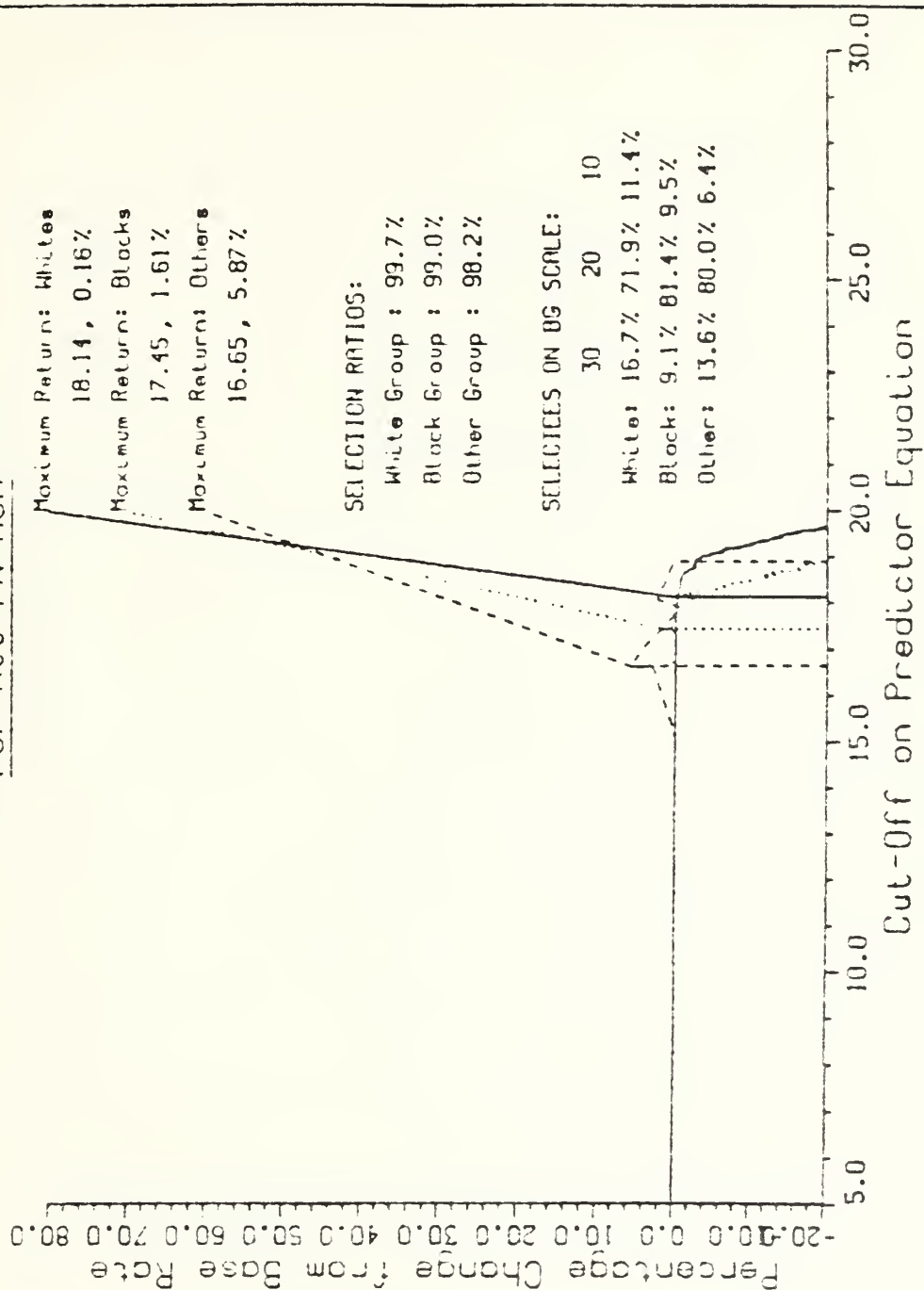


Figure 5.18 Race Specific Selection for PN on Badguy.



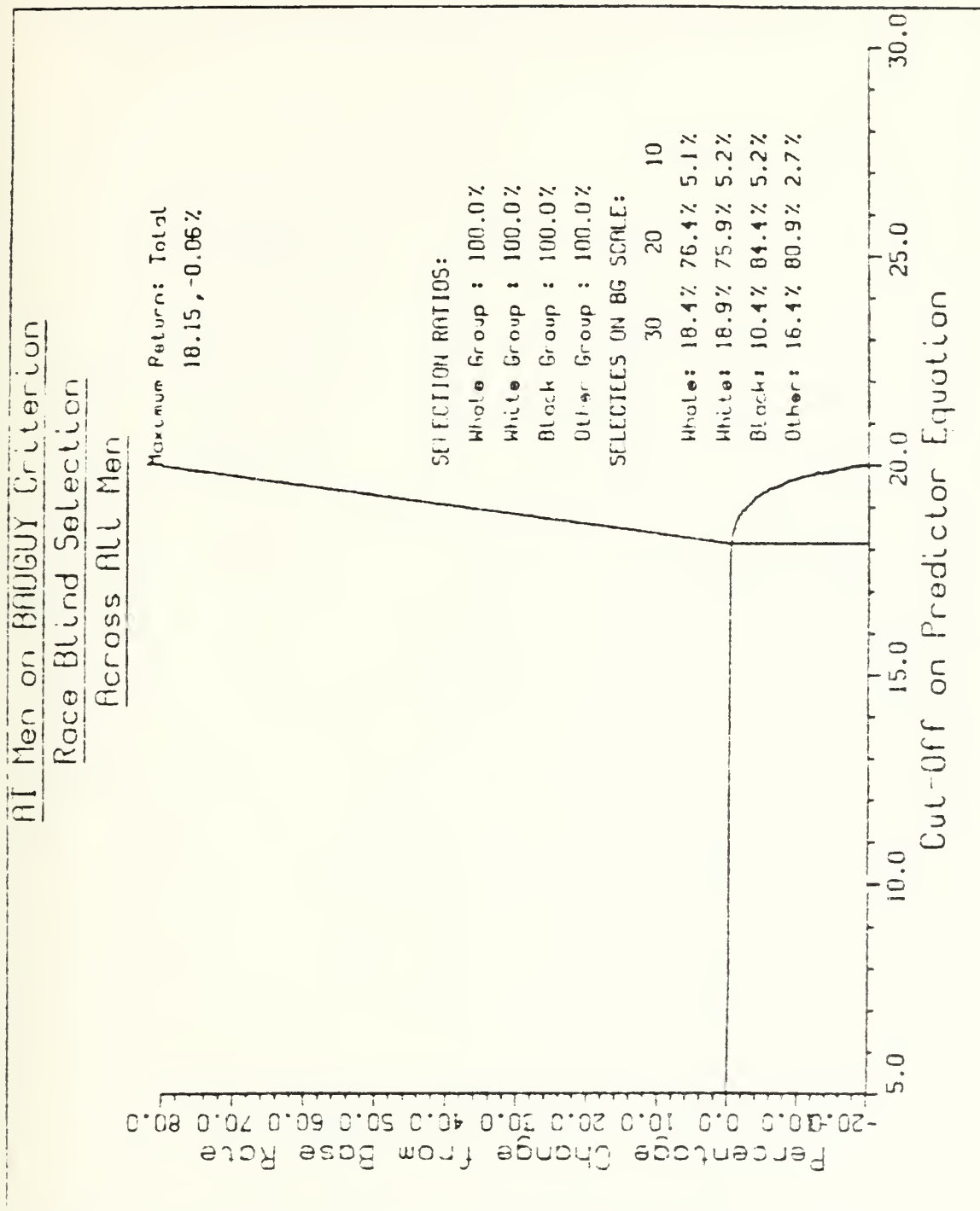


Figure 5.19 Race Blind Selection for AT on Badguy.



# AT Men on BADGUY Criterion

## Race Specific Selection

For ALL AT Men

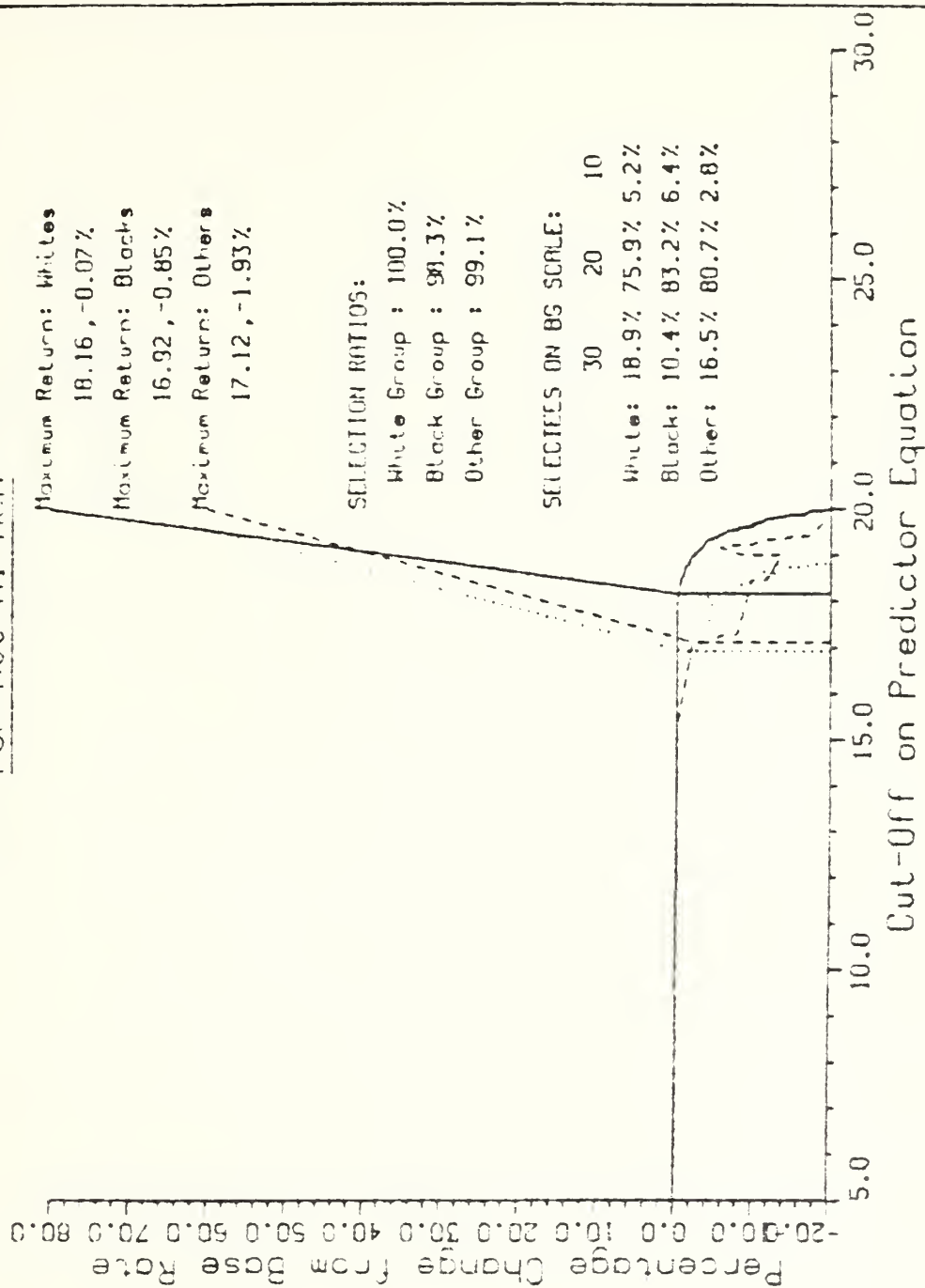


Figure 5.20 Race Specific Selection for AT on Badguy.



Women on BADGUY Criterion  
Race Specific Selection  
For PN & AT White Women

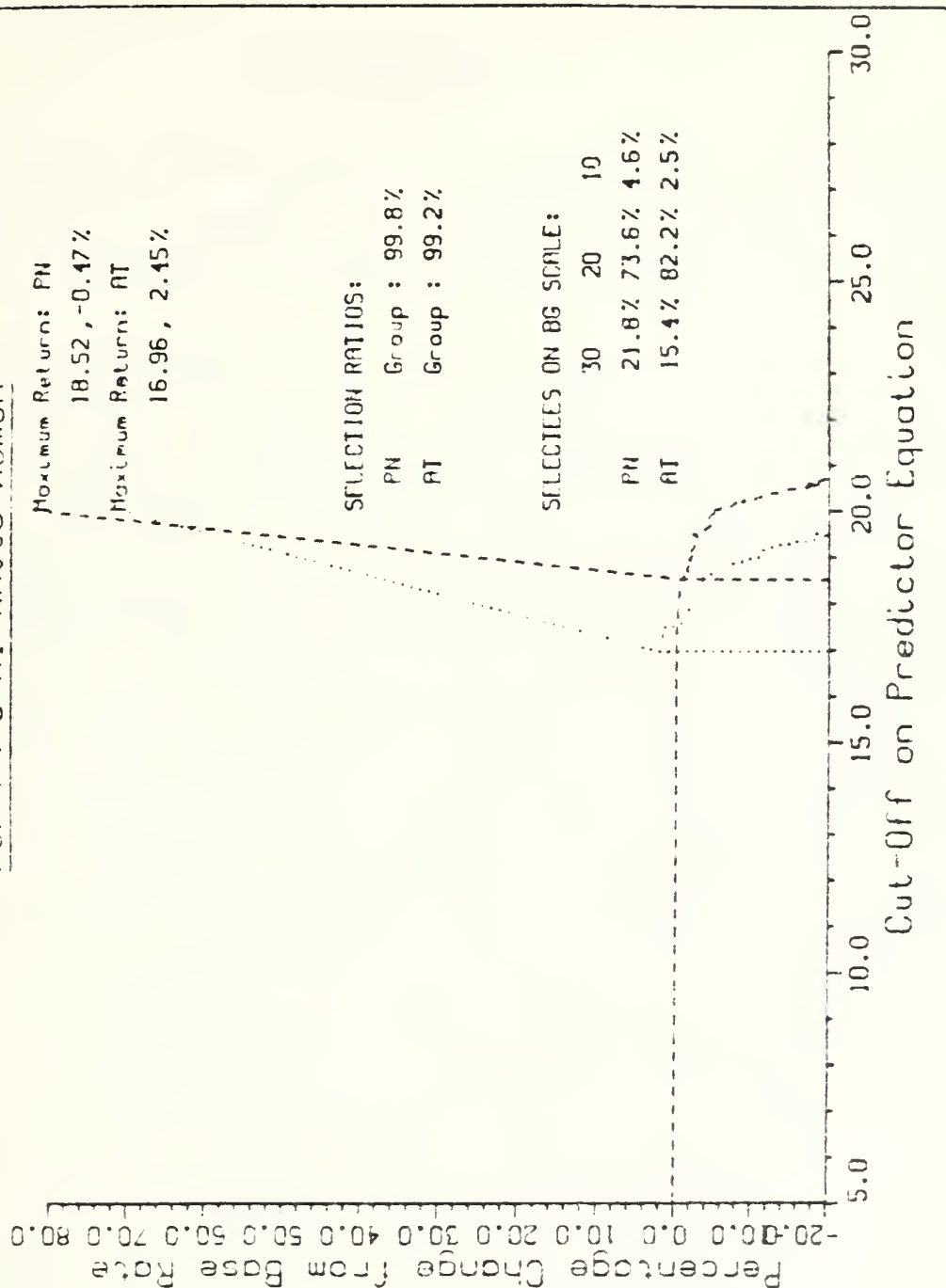


Figure 5.21 Rating Selection for PN & AT Women on Badguy.





## VI. DISCUSSION

This chapter is divided into two sections. The first deals with the results in relation to the research hypotheses. The second discusses other findings.

### A. RESEARCH HYPOTHESES

The stepwise regressions, particularly on the IOS criterion, tend to support the first hypothesis which predicted that entry age, education level and ability tests would be significant predictors of performance. Entry age was not selected for every regression, but it proved to be significant for at least one of the race/sex groupings on LOS for each rating. The relationship between age and the criterion was always positive: longer service is indicated for greater age at entry. Educational level was often selected too. However the direction of the relationship was not as consistent. For some groups it was positive and for others negative. There seems to be a trend for the coefficient for education level to be positive in low complexity ratings and negative in the higher complexity ratings. This finding could be related to restriction of range problems which were noted in the literature review. At least some of the ASVAB scores entered every stepwise regression. The signs were not consistently positive or negative.

At least for one criterion (i.e. LOS) the validity coefficients when averaged across groups, show a trend to increase with job complexity, a relationship predicted by the second hypothesis. On the whole, the validity coefficients are large enough to suggest that the predictor equations are sufficiently powerful to improve selection on



these three criteria. Comparing criteria, LOS has the highest validity.

## B. OTHER FINDINGS

The descriptive results yielded several general findings. They seem to support the view that whites have superior performances on psychometric tests of ability. On each of the ASVAB subtests, with one or two exceptions, the white group in each rating has performed better, in terms of raw score, means than the other two race groups. On the other hand, this race, for each rating, is younger at entry and (perhaps therefore) has the lowest educational level, with the smallest proportion being married variables which might be expected to be associated with lower ASVAB scores. For the SH and PN ratings, the white group has a shorter LOS, but with the highest proportions of in-service 'good' and 'bad' behaviours. For the AT rating, blacks and whites have about the same LOS (blacks serve slightly longer), and whites are more likely to have positive goodguy performances. The white women have similar performances as white men on both the predictor and criterion variables, except that they have the shortest LOS and generally exhibit the smallest percentage of 'bad' behaviours.

The estimation of cut-offs, for all criteria, has supported the notion that the significant relationship between predictors and criteria can be useful in a selection setting. As measured against the concept of base rate, many groupings within ratings can be better selected.

The findings of this research support the current US Navy selection procedures. For every stepwise regression in which it was selected, the SCREEN score (which is derived directly from the current procedures) was always positively related to the criterion.



From the averaged validities it appeared that the LOS predictors provide a means of increasing the selection utility across most trade, race and sex groupings. However, when optimum cut-offs were derived it was apparent that virtually none of the AT relationships would yield any reasonable utility improvement over the base rate. For the other ratings it appears that, except for SH blacks, there are positive returns to be obtained through selection based on the identified predictor/criterion relationships. The highest returns are for PN and AT women. This is despite the fact that some predictor equations had validities which were small, and in some cases statistically insignificant (e.g. FN 'other' and AT women). Apparently, although the validity coefficient was insignificant the relationship was still strong enough to yield a cutting score which improved overall utility.

The other two criteria, although they did not have double cross-validation coefficients which were as large as for LOS across groupings of personnel, also apparently are predictable from pre-entry information. However, when the cut-offs were determined, the goodguy criterion appeared to have potential for improving selection in all groupings, with the exception of AT white women. For only three groupings on the badguy criterion was a cut-off found which returned better than 5% over base rate. In a real sense these seem more useful criteria than LOS, since they appear to capture more relevant information relating product and/or cost. The extent that personnel are promoted during a period of service and the extent to which costly negative behaviours can be avoided are significant contributors to the organisations overall effectiveness. It would appear that the decision centered validity approach has revealed a number of potentially useful relationships which may be used for better selection.





The race blind selection cut-offs provided some interesting findings. For the SH rating in particular it seems clear that the white race would have greater proportions rejected than the other two racial groups if the race-blind prediction device was used. However, as has already been mentioned, more of the white SH personnel should be rejected since they exhibit poorer criterion performances than the 'other' races. For the PN rating, race blind selection also selects the smallest percentage of whites. This is a more curious result since for both ratings, most of the personnel were white and one would expect that they would dominate the regressions to the extent that greater proportions of whites would be selected than would the other races. For race specific selection the white selection ratio at the optimum cut-off is no longer the lowest for the LOS, but it is for the goodguy scale. It appears that whites do not perform as well as the other races in these ratings (PN and SH).

The decision centered validity approach has turned out to be a powerful tool for the present research. It has allowed a means of directly demonstrating the usefulness of a composite predictor in a future selection role. Provided appropriate utility values can be derived, it is obvious that the methodology employed in this study could be broadened. For example, in evaluating which cut-off to apply, the criterion can be segmented into as many separate categories as is required to reflect the different individual returns for the pairs of predictor outcomes. At one extreme in criterion categorisation is the LOS methodology employed here, in which the criterion was considered as a dichotomy. At the other is the situation in which each and every subject in the research could be individually evaluated in utility terms. For example, for every subject a value could be placed on the service he/she provided, and an estimation could be made as to the value to the Navy (positive or





negative) in the case that this person was not enlisted because of selection screening. These two values, which would probably not be the same, could be taken as predictor accept and predictor reject utilities and then used in exactly the same manner as in this study to determine an optimum predictor cutting-score which maximises total utility for all subjects. If the utility values were accurately derived from costs and products, then it may be possible to express selection utility in dollars per enlistee, which would be a readily acceptable means of justifying a selection procedure.

In applying the regression equations developed here to an actual setting, there are two other important considerations. These are both related to decisions that the Navy would make with respect to implementation. In this thesis, there was no external Navy decision as to which criteria of performance is the most useful for personnel selection. Length of service is widely used as a measure of good/desirable behaviour, but for some employments, it may not be so important. Indeed for some employments, "short" tenure may even be a goal (e.g. those employments which serve primarily to prepare personnel for later jobs). So before any attempt is made to implement these results the criterion would need to be specifically defined. It could be that there are other more pertinent criteria than those employed in this thesis.

The other issue about implementation is related to costs and has two aspects. First, the present study estimated costs and utilities through published cost data. These figures were clearly and directly relevant for the LOS criterion, but even in this application assumptions were made as to the relative value of the predictor/criterion outcomes. There are, perhaps, better accounting or economic procedures to estimate these values than was used here. An



evaluation of the utilities employed here is needed before implementation of these selection devices. Second, the other aspect of cost is directly related to implementation. In determining the optimum cutting-score on the predictive device for this study and expressing this as a percentage return over base rate, it is clear that it does not take into account any costs associated with implementation. A cost-benefit type of analysis would be necessary to weight up the total costs of implementing and maintaining the procedures, against the expected return in terms of more profitable selection. The data presented here are relevant to this type of analysis, but returns over base rate, for example, would need to directly take account of the numbers upon which each of the graphs in the previous chapter was based on. Some of the very high returns over base rate may be seen in a different light when the numbers of cases is taken into account. Base rate is a utility per enlistee: if the applicant pool is small, total utility (the product of the number of enlistees by utility per enlistee) might not be so high. If the cost of implementing and maintaining a procedure was very high, then the expected return over base rate would have to be even higher, so as to produce a positive return.



## VII. SUMMARY AND CONCLUSION

This thesis set out to develop selection standards for three US Navy ratings which varied in terms of their complexity requirements. The selection literature was extensively reviewed. This gave direction as to the variables likely to be predictive of subsequent performance as well as some guidelines for choosing appropriate criteria to predict. The method of evaluating the predictors in forecasting subsequent performances took two forms. The first was the traditional method for estimating validity coefficients through double cross-validation. The second applied utility estimates to various predictor/criterion outcomes so as to determine the cut-off score on the composite predictor which maximised overall utility. These analyses were done controlling for the effects of such moderator variables as job complexity, race and sex.

Within each rating a number of useful predictor/criterion relationships have been found. These relationships were shown to be valid and cutting scores derived which maximised total utility of the selection device. Some results suggest a significant race component in performance. This finding suggests the white race does not perform as well as the other races in the SH and PN rating. The signs on some ASVAB coefficients indicate negative relationships with criterion scores. This result was not expected.

This research has illustrated the relationships that exists in the data and the use to which they could be put for selection purposes. Implementation of any of these relationships as a selection tool requires a confirmation that the criteria used here are relevant and useful to personnel managers in the US Navy. In addition, the current



analysis has been performed without any consideration of the possible costs of the introduction and maintenance of the selection procedure. It would be necessary to conduct a cost benefit analysis to determine if the total expected returns from implementation were sufficient to compensate for the costs involved and therefore to produce a positive total return. To do this properly requires Navy decisions about the appropriateness of the criteria to be predicted and the utility and disutility values to be assigned to correct and incorrect predictor/criteria classifications. Such a cost benefit analysis has not been attempted here, but is relevant for future research.





## APPENDIX A

### EXAMPLE PROGRAM LISTINGS BASED ON PROCESSING SH

This appendix gives sample listings for the programs used to analyse the SH rating. These exactly parallel analyses for the other ratings.

#### 1. SAS Program to Select SH from NPS Cohort Data

On the following pages (Table XXVI) is a listing of the SAS job to select out the SH from the Cohort File of 206,000 and to place their records on Mass Storage.

The variables are read in from raw data and the first two pages of Table XXVI, show the variables locations and their descriptions. This lists all the variables available in the cohort even though only a small number of them were actually used for the present analysis.

The reader is referred to the SAS "User's Guide" for an explanation of the procedures involved. Comments throughout the listing explain some of the program steps.

#### 2. SAS Program to Perform Regressions

The following two tables give listings for two SAS programs.

The first (Table XXVII) is the one used perform stepwise regression on the whole set of predictors so as to select out those which the more useful. The reader will note that after the SH data is read in, it is sorted by race which facilitates the subsequent regressions which are performed by race.

The second (Table XXVIII) uses the output from the previous analyses to construct regression models for relevant race/sex groupings. The data is split, for each



grouping, into two random samples used as the basis for cross-validation. Predictor and criterion scores, after validation are then output, in raw data form, to mass storage so as to be available for later FORTRAN analysis in estimating cut-offs.

### 3. FORTRAN Program used to Estimate Cut-offs on Predictors

The raw output produced in the preceding SAS run is used as input data for this program (Table XXIX) along with the appropriate utility values.

The program is written so as to be run on one of the Navy Postgraduate School's terminals which is linked to a Tecktronics plotter, although it could easily be rewritten for a different plotting device. The plotting is performed using subroutines of the School's DISSPLA computer package.



## TABLE XXVI

## Listing of SAS Set-Up Program: Cohort to File

```

//NESBITTS JOB (2501,0171),'NESBITT ',CLASS=K
//*MAIN ORG=NEGVM1.2501P
//EXEC PGM=IEFBR14
//DD1 DD DISP=(OLD,DELETE),DSN=MSS.S2501.NRATESH
//EXEC SAS
//SAS.WORK DD SPACE=(CYL,(10,10)),
//          DISP=(NEW,DELETE,DELETE)
//VOL=SER=(MVS007,MVS012,MVS009,MVS004),UNIT=3350
//FILEIN DD UNIT=3400-5,VOL=SER=ENLIST,
//DISP=OLD,DSN=ENLIST.ALL.A7678
//FILEOUT DD UNIT=3330V,MSVGP=PUB4B,
//DISP=(NEW,CATLG),DSN=MSS.S2501.NRATESH,
//DCB=(BLKSIZE=6400)
//SYSIN DD *
CFTICNS ERRORS=5;
DATA FILEOUT.NRATESH;
  INFILE FILEIN; INPUT
@ 16 ENTRYAGE PIB1. @ 17 RECORDID PIB1.
@ 18 HYECC PIB1. @ 19 SEX PIB1.
@ 20 RACE PIB1. @ 23 MRTLDPND PIB1.
@ 24 TESTFORM PIB1. @ 25 AFQTPCNT PIB1.
@ 26 AFQTGRPS PIB1. @ 27 ASVABGI PIB1.
@ 28 ASVABNO PIB1. @ 29 ASVABAD PIB1.
@ 30 ASVABWK PIB1. @ 31 ASVABAR PIB1.
@ 32 ASVABSP PIB1. @ 33 ASVABMK PIB1.
@ 34 ASVABEI PIB1. @ 35 ASVABMC PIB1.
@ 36 ASVABEGS PIB1. @ 37 ASVABSI PIB1.
@ 38 ASVABAI PIB1. @ 39 SERVACCS PIB1.
@ 40 PRIORSRV PIB1. @ 43 ASVABCM PIB1.
@ 44 ASVABCA PIB1. @ 45 ASVABCE PIB1.
@ 46 ASVABCC PIB1. @ 58 ENTRYYR PIB1.
@ 61 TERMENLT PIB1. @ 62 ENTRPAYG PIB1.
@ 59 ENTRYMTH PIB1. @ 60 ENTRYDAY PIB1.
@ 65 PROGENLT PIB5. @ 73 BONUSOPT PIB1.
@ 74 ENLSTOPT PIB1. @ 75 YOUTHPRG PIB1.
@ 78 TAPEDATE PIB1. @ 81 TRENLMOS PIB5.
@ 86 TAFMS1 PIB2. @ 88 DPOC1 PIB2.
@ 90 DDOC1 PIB2. @ 92 HYECC1 PIB1.
@ 93 PAYGRDE1 PIB1. @ 94 SERVICE1 PIB1.
@ 95 MRTSTAT1 PIB1. @ 96 NDEPDNT1 PIB1.
@ 97 SPNSPD1 PIB3. @100 ISC1 PIB1.
@101 SEPRT1YR PIB1. @102 SEPRT1MT PIB1.
@103 SEPRT1DY PIB1. @104 BASD1YR PIB1.
@105 BASD1MTH PIB1. @106 BASD1DAY PIB1.
@107 ETS1YEAR PIB1. @108 ETS1Mnth PIB1.
@109 DOLE1YR PIB1. @110 DOLE1MTH PIB1.
@113 FEBD1YR PIB1. @114 FEBD1MTH PIB1.
@115 FEBD1DAY PIB1. @111 CHARSRV1 PIB1.
@112 ELGREUP1 PIB1. @116 FILEFLG1 PIB2.
@118 TAFMS2 PIB2. @120 DPOC2 PIB2.
@122 DDOC2 PIB2. @124 HYECC2 PIB1.
@125 PAYGRDE2 PIB1. @126 SERVICE2 PIB1.
@127 MRTSTAT2 PIB1. @128 NDEPDNT2 PIB1.
@129 SPNSPD2 PIB3. @132 ISC2 PIB1.
@133 SEPRT2YR PIB1. @134 SEPRT2MT PIB1.
@135 SEPRT2DY PIB1. @136 BASD2YR PIB1.
@137 BASD2MTH PIB1. @138 BASD2DAY PIB1.
@139 ETS2YEAR PIB1. @140 ETS2Mnth PIB1.
@141 DOLE2YR PIB1. @142 DOLE2MTH PIB1.
@145 FEBD2YR PIB1. @146 FEBD2MTH PIB1.
@147 FEBD2DAY PIB1. @143 CHARSRV2 PIB1.
@144 ELGREUP2 PIB1. @148 FILEFLG2 PIB2.
@150 TAFMS3 PIB1. @151 TAFMS4 PIB1.
@152 DPOC3 PIB2. @154 DDOC3 PIB2.

```



@156	HYEC3	FIB1.	@157	PAYGRDE3	PIB1.
@158	SERVICE3	PIB1.	@159	MRTSTAT3	PIB1.
@160	NDPNDNT3	PIB1.	@161	SPNSPD3	PIB3.
@165	SEPRT3YR	PIB1.	@166	SEPRT3MT	PIB1.
@167	SEPRT3DY	PIB1.	@168	BASD3YR	PIB1.
@169	BASD3MTH	PIB1.	@170	BASD3DAY	PIB1.
@171	ETS3YEAR	PIB1.	@172	ETS3MNTH	PIB1.
@173	DOLE3YR	PIB1.	@174	DOLE3MTH	PIB1.
@177	PEBD3YR	PIB1.	@178	PEBD3MTH	PIB1.
@179	PEBD3DAY	PIB1.	@164	ISC3	PIB1.
@175	CHARSRV3	PIB1.	@176	ELGREUP3	PIB1.
@180	FILEFLG3	PIB2.	@182	FILEMTCH	PIB4.
@186	DOEYRDEP	PIB1.	@187	DOEMTDEP	PIB1.
@188	MNTHSDEP	PIB1.	@189	SPFLGML	PIB1.
@190	DCPGYR	PIB1.	@191	DCPGMNTH	PIB1.
@212	GCT 2.	@214	ARI 2.	@216	MECH 2.
@218	CLER 2.	@220	AFCTS 2.	@222	PNEC \$4.
@227	CTZNSHIP	\$1.	@229	PRIDEPND	\$1.
@230	SECDEPND	\$1.	@231	BRCL	\$2.
@233	GROUFIN	\$1.	@234	AUTHRATE	\$4.
@240	EDPGYR	\$4.	@244	SCHLCODE	\$1.
@245	SCHLWVR	\$1.	@246	ASTAR	\$1.
@247	TSIND	\$1.	@250	PRESRATE	\$4.
@254	NUMPG1	\$1.	@255	PRRTABRV	\$3.
@258	EXAMRATE	\$4.	@262	NUMPG2	\$1.
@263	EXRTABRV	\$3.	@266	TOTLRAW	3.
@269	STDNAVY	2.	@272	PRCODE	\$2.
@274	ALTPRCDE	\$2.	@276	FINLMULT	5.
@281	FNMLTCUT	5.	@287	PRFFACTR	3.
@290	AWIFACTR	2.	@292	CHNGRATE	\$1.
@296	RATEIND	\$1.	@297	SPPROIND	\$1.
@298	TYPENLST	\$2.	@301	MODEST	\$1.
@302	NENLSTMT	1.	@303	EAOS YYMMD	6.
@309	TAS	\$4.	@313	OAS	\$4.
@317	LOSCODE	\$1.	@318	LOS WVR	\$1.
@319	SIPG	\$4.	@323	TIR WVR	\$1.
@324	TIR	\$4.	@336	ADBD YYMMD	6.
@343	EDPG YYMMD	6.	@349	DTIS	3.
@352	RECFORE	1.	@356	NCHANGES	3.
@384	AGE	2.	@386	NHRCGCT	2.
@388	NHRC AFOT	2.	@390	MENTLGRP	\$1.
@391	EDCERTIF	\$1.	@392	MOBLDSGN	\$1.
@394	HYNDPNDT	2.	@396	GRP4PROG	\$2.
@398	SSDUTY	\$1.	@399	REGRESRV	\$1.
@400	HYPAYGRD	\$1.	@401	NOTRCMD	\$1.
@402	SSNCHNGE	\$1.	@403	TOTPRMO	2.
@405	TOTLDEMO	1.	@406	TOTLAWOL	1.
@407	TOTDESRT	1.	@408	TOTMLTCN	1.
@409	TOTCVLCN	1.	@412	LNGTHSRV	\$4.
@416	SCREEN	2.	@418	ATTRITCD	\$1.
@419	RECNTC	\$1.	@420	RECENLST	\$2.
@422	RECPRGGM	\$1.	@423	RECPRGSC	\$2.
@425	PCPGSCRT	\$4.	@435	ELSTHIST	\$1.
@436	NDAYSE2	4.	@440	NDAYSE3	4.
@444	NDAYSE4	4.	@449	DMDCRATE	\$3.
@452	DMDCNEC	\$4.	@456	DMDCUIC	\$6.
@480	EARNNEC	\$4.	@484	TRAININD	\$1.
@485	STACTION	\$1.;			

IAEEL

ENTRYAGE=AGE OF INDIVIDUAL AT TIME OF ENTRY  
 RECFDID=RECORD ID--EXAM SCORE, DEP, ACTIVE DUTY  
 HYEC = HIGHEST YEAR OF EDUCATION  
 SEX = (1) MALE, (2) FEMALE  
 RACE = (1) WHITE, (2) BLACK, (3) OTHER  
 MRTLDEND=MARITAL STATUS/DEPENDENTS  
 TESTFORM=TEST FORM/ECFA, ASVAB, AFWST, AFOT, OSB...  
 AFCTPCNT=AFOT PERCENTILE (OR EQUIVALENT)  
 AFOTGRPS=AFOT GROUPS (5, 4C, 4B, 4A, 3B, 3A, 2, 1)  
 ASVAEGI = ASVAE APTITUDE AREA SCORE--SUBSCALE GI







ASVABNO =ASVAE APTITUDE AREA SCORE--SUBSCALE NO  
 ASVAEAD =ASVAE APTITUDE AREA SCORE--SUBSCALE AD  
 ASVAEWK =ASVAB APTITUDE AREA SCORE--SUBSCALE WK  
 ASVAEAR =ASVAE APTITUDE AREA SCORE--SUBSCALE AR  
 ASVAESP =ASVAE APTITUDE AREA SCORE--SUBSCALE SP  
 ASVAEMK =ASVAE APTITUDE AREA SCORE--SUBSCALE MK  
 ASVABEI =ASVAB APTITUDE AREA SCORE--SUBSCALE EI  
 ASVAEMC =ASVAE APTITUDE AREA SCORE--SUBSCALE MC  
 ASVABGS =ASVAB APTITUDE AREA SCORE--SUBSCALE GS  
 ASVAESI =ASVAE APTITUDE AREA SCORE--SUBSCALE SI  
 ASVABAI =ASVAB APTITUDE AREA SCORE--SUBSCALE AI  
 SEFVACCS=SERVICE OF ACCESSION (NAVY,2)  
 PRIORSRV=PRIOR SERVICE (NON-PRIOR SERVICE,1)  
 ASVAECM =ASVAE APTITUDE AREA SCORE--SUBSCALE CM  
 ASVABCA =ASVAB APTITUDE AREA SCORE--SUBSCALE CA  
 ASVAECE =ASVAE APTITUDE AREA SCORE--SUBSCALE CE  
 ASVABCC =ASVAB APTITUDE AREA SCORE--SUBSCALE CC  
 TERMENLT=TERM OF ENLISTMENT (NO. OF YEARS)  
 ENTRPAYG=ENTRY PAY GRADE (E00--011)  
 PFOGENLT=PROGRAM ENLISTED FOR--SERVICE UNIQUE  
 BCNUSOPT=BONUS OPTION, COMBAT OR NON-COMBAT  
 ENLSTOPT=ENLISTMENT OPTION  
 YOUTHPRG=YOUTH & RESERVE TRAINING PROGRAMS  
 TAPEDATE=MONTH OF FILE ON WHICH RECORD SUBMITTED  
 TRENL MOS =OCCUP. SPECIAL./RATING CHOICE UPON ENTRY  
 TAFMS1 =MONTHS OF TOTL. ACTIVE FED. MILIT. SERV.  
 DECC1 =D.O.D. PRIMARY OCCUPATION CODE  
 DDOC1 =D.O.D. DUTY OCCUPATION CODE  
 HVEC1 =HIGHEST YEAR OF EDUCATION  
 PAYGRDE1=PAY GRADE AS-OF-DATE-OF-FILE/SEPARATION  
 SERVICE1=SERVICE CODE (2, NAVY)  
 MRTSTAT1=MARITAL STATUS (1,OTHER, 2,MARRIED)  
 NDENDNT1=NUMBER OF DEPENDENTS (1, NONE)  
 SENSEPD1=SEPARATION PROGRAM DESIGNATOR  
 ISC1 =INTER-SERVICE SEPARATION CODE  
 SEPRT1YR=YEAR OF SEPARATION (2ND DMDC SECTION)  
 SEPRT1MT=MONTH OF SEPARATION (2ND DMDC SECTION)  
 SEPRT1DY=DAY OF SEPARATION (2ND DMDC SECTION)  
 BASD1YR=YEAR OF ACTIVE DUTY BASE DATE  
 BASD1MTH=MONTH OF ACTIVE DUTY BASE DATE  
 BASD1DAY=DAY OF ACTIVE DUTY BASE DATE  
 ETS1YEAR=ESTIMATED YEAR OF FULFILLED ACTIVE DUTY  
 ETS1MNT=ESTIMATED MONTH OF FULFILLED ACTIVE DUTY  
 CHARSRV1=CHARACTER OF SERVICE  
 ELGREUP1=REENLISTMENT ELIGIBILITY  
 PEED1YR=YEAR OF PAY ENTRY BASE DATE  
 PEED1MTH=MONTH OF PAY ENTRY BASE DATE  
 PEED1DAY=DAY OF PAY ENTRY BASE DATE  
 ENTRYYR=YEAR OF ENTRY TO ACTIVE/D.E.P.  
 ENTRYMTH=MONTH OF ENTRY TO ACTIVE/D.E.P.  
 ENTRYDAY=DAY OF ENTRY TO ACTIVE/D.E.P.  
 SEPRT1YR=YEAR OF SEPARATION (2ND DMDC SECTION)  
 SEPRT1MT=MONTH OF SEPARATION (2ND DMDC SECTION)  
 SEPRT1DY=DAY OF SEPARATION (2ND DMDC SECTION)  
 BASD1YR=YEAR OF ACTIVE DUTY BASE DATE  
 BASD1MTH=MONTH OF ACTIVE DUTY BASE DATE  
 BASD1DAY=DAY OF ACTIVE DUTY BASE DATE  
 ETS1YEAR=ESTIMATED YEAR OF FULFILLED ACTIVE DUTY  
 ETS1MNT=ESTIMATED MONTH OF FULFILLED ACTIVE DUTY  
 PEED1YR=YEAR OF PAY ENTRY BASE DATE  
 PEED1MTH=MONTH OF PAY ENTRY BASE DATE  
 PEED1DAY=DAY OF PAY ENTRY BASE DATE  
 FILEFLG1=FILE FLAG NO. 1  
 PEED2YR=YEAR OF PAY ENTRY BASE DATE  
 PEED2MTH=MONTH OF PAY ENTRY BASE DATE  
 PEED2DAY=DAY OF PAY ENTRY BASE DATE  
 SEPRT2YR=YEAR OF SEPARATION (3RD DMDC SECTION)  
 SEPRT2MT=MONTH OF SEPARATION (3RD DMDC SECTION)  
 SEPRT2DY=DAY OF SEPARATION (3RD DMDC SECTION)



EASD2YR =YEAR OF ACTIVE DUTY BASE DATE  
 BASD2MTH=MONTH OF ACTIVE DUTY BASE DATE  
 EASD2DAY=DAY OF ACTIVE DUTY BASE DATE  
 EIS2YEAR=ESTIMATED YEAR OF FULFILLED ACTIVE DUTY  
 EIS2MTH=ESTIMATED MONTH OF FULFILLED ACTIVE DUTY  
 PEED2YR =YEAR OF PAY ENTRY BASE DATE  
 PEBD2MTH=MONTH OF PAY ENTRY BASE DATE  
 PEBD2DAY=DAY OF PAY ENTRY BASE DATE  
 TAFMS2 =MONTHS OF TOTL. ACTIVE FED. MILIT. SERV.  
 DPCC2 =D.O.D. PRIMARY OCCUPATION CODE  
 DLOC2 =D.O.D. DUTY OCCUPATION CODE  
 HVEC2 =HIGHEST YEAR OF EDUCATION  
 PAYGRDE2=PAY GRADE AS-OF-DATE-OF-FILE/SEPARATION  
 SERVICE2=SERVICE CODE (2, NAVY)  
 MRTSTAT2=MARITAL STATUS (1,OTHER, 2,MARRIED)  
 NDENDNT2=NUMBER OF DEPENDENTS (1, NONE)  
 SPNSPD2 =SEPARATION PROGRAM DESIGNATOR  
 ISC2 =INTER-SERVICE SEPARATION CODE  
 CHARSRV2=CHARACTER OF SERVICE  
 ELGREUP2=REENLISTMENT ELIGIBILITY  
 FILEFLG2=FILE FLAG NO. 2  
 PEED3YR =YEAR OF PAY ENTRY BASE DATE  
 PEED3MTH=MONTH OF PAY ENTRY BASE DATE  
 PEED3DAY=DAY OF PAY ENTRY BASE DATE  
 SEPRT3YR=YEAR OF SEPARATION (4TH DMDC SECTION)  
 SEPRT3MT=MONTH OF SEPARATION (4TH DMDC SECTION)  
 SEPRT3DY=DAY OF SEPARATION (4TH DMDC SECTION)  
 EASD3YR =YEAR OF ACTIVE DUTY BASE DATE  
 BASD3MTH=MONTH OF ACTIVE DUTY BASE DATE  
 EASD3DAY=DAY OF ACTIVE DUTY BASE DATE  
 EIS3YEAR=ESTIMATED YEAR OF FULFILLED ACTIVE DUTY  
 EIS3MTH=ESTIMATED MONTH OF FULFILLED ACTIVE DUTY  
 PEED3YR =YEAR OF PAY ENTRY BASE DATE  
 PEBD3MTH=MONTH OF PAY ENTRY BASE DATE  
 PEBD3DAY=DAY OF PAY ENTRY BASE DATE  
 TAFMS3 =MONTHS OF TCTL. ACTIVE FED. MILIT. SERV.  
 TAFMS4 =MONTHS OF TOTL. ACTIVE FED. MILIT. SERV.  
 DPCC3 =D.O.D. PRIMARY OCCUPATION CODE  
 DLOC3 =D.O.D. DUTY OCCUPATION CODE  
 HVEC3 =HIGHEST YEAR OF EDUCATION  
 PAYGRDE3=PAY GRADE AS-OF-DATE-OF-FILE/SEPARATION  
 SERVICE3=SERVICE CODE (2, NAVY)  
 MRTSTAT3=MARITAL STATUS (1,OTHER, 2,MARRIED)  
 NDENDNT3=NUMBER OF DEPENDENTS (1, NONE)  
 SPNSPD3 =SEPARATION PROGRAM DESIGNATOR  
 ISC3 =INTER-SERVICE SEPARATION CODE  
 CHARSRV3=CHARACTER OF SERVICE  
 ELGREUP3=REENLISTMENT ELIGIBILITY  
 FILEFLG3=FILE FLAG NO. 2  
 FILEMTCH=4-BYTE BINARY FILE MATCH INDICATORS  
 DCEYRDEP=DOE YEAR INTO D.E.P.  
 DCEMIDEP=DOE MCNTH INTO D.E.P.  
 MNTHSDEP=MONTHS IN D.E.P.  
 SPFLGML =SPANISH FLAG MASTER/LOSS  
 DCPGMNTH=MONTH OF DCPG  
 DCPGYR =YEAR OF DCPG  
 GCT =BASIC BATTERY GCT  
 ARI =BASIC BATTERY ARI  
 MECH =BASIC BATTERY MECH  
 CLER =BASIC BATTERY CLER  
 FNEC =NAVY ENLISTED JOB CODE  
 CITZNSHIP=CITIZENSHIP CODE  
 BRCL =BRANCH/CLASS  
 GROUPIND=GROUP INDICATOR  
 AUTHRATE=AUTHORIZED RATE (ABBR.)  
 EDPGYR =EFFECTIVE DATE OF PAY GRADE  
 SCHLCODE=SCHOL CODE  
 SCHLWVR =SCHOL WAIVER  
 PRESRATE=PRESENT RATE CODE





PRRTAERV=PRESENT RATE (ABBR.)  
 EXAMRATE=EXAMINATION RATE CODE  
 EXRTABRV=EXAMINATION RATE (ABBR.)  
 TCTLRAW =TOTAL RAW SCORE  
 SIDNAVY =STANDARDIZED NAVY SCORE  
 PRCODE =PROCESS CODE  
 ALTPRCDE=ALTERNATE PROCESS CODE  
 FINLMULT=CANDIDATE'S FINAL MULTIPLE  
 FNMLTCUT=FINAL MULTIPLE CUT  
 PFFACTR=PERFORMANCE FACTOR  
 AWIFACTR=AWI FACTOR  
 CHNGRATE=CHANGE OF RATE INDICATOR  
 ENLSTMT=NUMBER OF ENLISTMENTS  
 EAOS =EXPIRATION OF ACTIVE OBLIGATED SERVICE  
 TAS =TOTAL ACTIVE SERVICE  
 CAS =OTHER ACTIVE SERVICE  
 SIFG =SERVICE IN PAY GRADE  
 LCSCCDE =LENGTH OF SERVICE  
 LCSWVR =LENGTH OF SERVICE WAIVER  
 TIRWVR =TIME IN RATE WAIVER  
 TIR =TIME IN RATE  
 ALED =ACTIVE DUTY BASE DATE  
 EDPG =EFFECTIVE DATE OF PAY GRADE  
 DTIS =DRILL TIME IN SERVICE  
 NCHANGES=NUMBER OF CHANGES/ENTRIES IN NHRC FILE  
 AGE =CANDIDATE'S CURRENT AGE  
 NHRCGCT =NHRC FILE'S GENRL. CLASSIFICATION TEST  
 NHRCAFOT=NHRC FILE'S ARMED FORCES QUALIFY. TEST  
 MENTLGRP=MENTAL GROUP CODE  
 EDCERTIF=EDUCATION CERTIFICATE  
 MOBLDSGN=MILITARY OBLIGATION DESIGNATOR  
 HYNDENDT=HIGHEST NUMBER OF PRIMARY DEPENDENTS  
 GFP4PROG=GROUP IV (100K) PROGRAM CODE  
 SSDUTY =SEA-SHORE DUTY INDICATOR  
 REGRESRV=REGULAR RESERVE INDICATOR  
 HYPAYGRD=HIGHEST PAY GRADE  
 NOTRCMD =NOT RECOMMENDED FOR RE-ENLISTMENT  
 SSNCHNGE=SOCIAL SECURITY/NAME CHANGE  
 TCTIPROMO=TOTAL PROMOTIONS  
 TCTLDEMO=TOTAL DEMOTIONS  
 TCTLAWOL=TOTAL UA/AWCL  
 TCTDESRT=TOTAL DESERTIONS  
 TCTMLTCN=TOTAL MILITARY CONFINEMENTS  
 TCTCVLCN=TOTAL CIVILIAN CONFINEMENTS  
 LNGTHSRV=LENGTH OF SERVICE  
 SCREEN =SCREEN SCORE  
 ATTRITCD=ATTRITION INDICATOR  
 RECNTC =RECRUIT NAVAL TRAINING COMMAND  
 RECNLST=RECRUIT TYPE ENLISTMENT  
 RECPRCGM=RECRUIT PROGRAM AT ENLISTMENT  
 RECPRGSC=RECRUIT PROGRAM/SCHOOL  
 RCPGSCRT=RECRUIT PROGRAM/SCHOOL RATE  
 ELSTHIST=ENLISTED HISTORY STATUS  
 NCAYSE2 =COMPUTED NUMBER OF DAYS TO E-2 RATING  
 NCAYSE3 =COMPUTED NUMBER OF DAYS TO E-3 RATING  
 NCAYSE4 =COMPUTED NUMBER OF DAYS TO E-4 RATING  
 DCLE1YR =YEAR OF LATEST RE-ENLISTMENT  
 DCLE1MTH=MONTH OF LATEST RE-ENLISTMENT  
 DCLE2YR =YEAR OF LATEST RE-ENLISTMENT  
 DCLE2MTH=MONTH OF LATEST RE-ENLISTMENT  
 DCLE3YR =YEAR OF LATEST RE-ENLISTMENT  
 DCLE3MTH=MONTH OF LATEST RE-ENLISTMENT  
 DMDCRATE=FINAL RATING AS LISTED BY D.M.D.C.  
 DMDCNEC =FINAL N.E.C. AS LISTED BY D.M.D.C.  
 DMDCUIC =FINAL U.I.C. AS LISTED BY D.M.D.C.  
 CCNVCATE=CONVENING DATE FOR NITRAS COURSE  
 GRADDATE=GRADUATION DATE FOR NITRAS COURSE  
 TRANDATE=TRANSACTION DATE FOR NITRAS RECORD  
 EARNNEC =DID CANDIDATE EARN AN NEC?



```

TRAININD=TRAINING INDICATOR
STACTION=STUDENT ACTION CODES (PASS, P, ETC.);
IF DMDCRATE='SH' OR PRRTABRV='SH' OR
    RCPGSCRT='2490' OR EXAMRATE='2490';
PRCC FREQ;
    TABLES DMDCRATE PRRTABRV RCPGSCRT
        AUTHRATE PRESRATE EXAMRATE;
    TITLE ATTEMPT AT FORMING AN SH FILE;
/*
//

```





## TABLE XXVII

## Program Listing of Stepwise Regression for SH

```

//NESBITTS JOE (2501,0171),'NESBITT ',CLASS=C
//*MAIN LINES=(25),ORG=NPGVM1.2501P
// EXEC SAS
//SAS.WORK DD SPACE=(CYL,(25,50)),
// DISP=(NEW,DELETE,DELETE)
//FILEIN DD DISP=SHR,DSN=MSS.S2501.NRATESH
//SYSIN DD *
OPTICNS LS=80 NOCENTER NODATE;
DATA;SET FILEIN.NRATESH;
* -----
| NUMBER OF YEARS OF EDUCATION IS CONVERTED FROM |
| ITS DMDC ORDINAL CODING (1-13) TO A numeric. |
| -----
IF HYEC=1 THEN CHYEC=3.5;IF HYEC=2 THEN CHYEC=8;
IF HYEC=3 THEN CHYEC=9;IF HYEC=4 THEN CHYEC=10;
IF HYEC=5 THEN CHYEC=11;IF HYEC=6 THEN CHYEC=12;
IF HYEC=7 THEN CHYEC=13;IF HYEC=8 THEN CHYEC=14;
IF HYEC=9 THEN CHYEC=15;IF HYEC=10 THEN CHYEC=16;
IF HYEC=11 THEN CHYEC=18;IF HYEC=12 THEN CHYEC=20;
IF HYEC=13 THEN CHYEC=11.5;
* -----
| VALIDITY VALUE SCREENS |
| -----
IF ENTRYAGE GE 35 THEN ENTRYAGE=35;
IF ENTRYAGE >= 17;IF TOTPRMO<=5;
IF SCHLCODE='A' THEN SCHLCODE='1';
ELSE SCHLCODE='0';NUSCHCDE=SCHLCODE+0;
NUATTRIT=ATTRITCD+0;IF NUATTRIT=2 THEN
NUATTRIT=1;ELSE NUATTRIT=0;
NUNOTRC=NOTRCMD+0;
NUHYPAY=HYPAYGRD+0;
YEAR=SUBSTR(LNGTHSRV,1,2);
MCNTH=SUBSTR(LNGTHSRV,3,2);
YEARS=YEAR+0;MCNTHS=MONTH+0;
LCSMNTHS=YEARS*12+MCNTHS;
IF MCNTHS >= 6 THEN YEARS=YEARS+1;
ONEYEAR=0;IF LCSMNTHS >= 12 THEN ONEYEAR=1;
TWOYEAR=0;IF LOSMNTHS >= 24 THEN TWOYEAR=1;
THRYEAR=0;IF LOSMNTHS >= 36 THEN THRYEAR=1;
FORYEAR=0;IF LOSMNTHS >= 48 THEN FORYEAR=1;
LABEL LOSMNTHS=TOTAL LOS IN MONTHS (NUMERIC);
* -----
| the highest paygrade is determined |
| -----
IF FILEFLG1=8209 THEN PAYGRADE=PAYGRDE1;
IF FILEFLG1 NE 8209 THEN PAYGRADE=PAYGRDE3;
IF PAYGRADE>=2 THEN NDAYSE22=NDAYSE2;ELSE NDAYSE22=0;
IF PAYGRADE>=3 THEN NDAYSE23=NDAYSE3;ELSE NDAYSE23=0;
IF PAYGRADE>=4 THEN NDAYSE24=NDAYSE4;ELSE NDAYSE24=0;
IF NDAYSE22=0 THEN NDAYSE22=1275;
IF NDAYSE23=0 THEN NDAYSE23=1461;
IF NDAYSE24=0 THEN NDAYSE24=1750;
TIMEE2=0.;
TIMEE3=0.;
TIMEE4=0.;
TIMEE2=(ROUND(((NDAYSE22)/(365/12))*10)/10);
TIMEE3=(ROUND(((NDAYSE23)/(365/12))*10)/10);
TIMEE4=(ROUND(((NDAYSE24)/(365/12))*10)/10);
LABEL
TIMEE2 =ROUNDED NUMBER OF MONTHS TO E2
TIMEE3 =ROUNDED NUMBER OF MONTHS TO E3
TIMEE4 =ROUNDED NUMBER OF MONTHS TO E4;
* -----
| DEFINES "ELIGIBILITY TO RE-ENLIST". |

```



```

-----;
IF FILEFLG1=8209 THEN ELIGREUP=1;
IF ((FILEFLG1 NE 8209) AND (ISC3 GT 0) AND
(ELIGREUP3 EQ 1)) THEN ELIGREUP=1; ELSE ELIGREUP=0;
*
| defines "ACHIEVED E-4", IN JOINT |
| CONSIDERATION OF THE D.M.D.C. AND N.H.R.C. |
-----;
IF ((PAYGRADE GE 4) AND (HYPAYGRD GE 4)) THEN ACHVDE4=1;
IF ((PAYGRADE LT 4) OR (HYPAYGRD LT 4)) THEN ACHVDE4=0;
*
| defines "RATED" VERSUS "NOT-RATED". |
-----;
IF ((DMDCRATE NE '.') AND (DMDCRATE NE ' '))
AND (SERVACCS EQ 2) AND (SERVICE1 EQ 2) AND
((PAYGRADE GE 4) AND (HYPAYGRD GE 4)) THEN
RATED=1; ELSE RATED=0;
*
| eliminates invalid asvab subscale scores |
-----;
IF ASVABGI<=15; IF ASVABNO<=50; IF ASVABAD<=30;
IF ASVABWK<=30; IF ASVABAR<=20; IF ASVABSP<=20;
IF ASVABMK<=20; IF ASVABFI<=30; IF ASVABMC<=30;
IF ASVABGS<=20; IF ASVABSI<=20; IF ASVABAI<=20;
IF ASVABCM<=30; IF ASVABCA<=20; IF ASVABCE<=30;
IF ASVABCC<=30;
*
| establishes entry groups:
|
| entry      exam      dmdc
| {1}        yes       yes       yes
| {2}        yes       yes       no
| {3}        yes       no        yes
| {4}        yes       no        no
| {5}        no        yes       yes
| {6}        no        yes       no
| {7}        no        no        yes
|
|-----;
IF (RCPGSCRT='2490' AND EXAMRATE='2490'
AND DMDCRATE='SH') THEN ENTRYGRP=1;
IF (RCPGSCRT='2490' AND EXAMRATE='2490'
AND DMDCRATE NE 'SH') THEN ENTRYGRP=2;
IF (RCPGSCRT='2490' AND EXAMRATE NE '2490'
AND DMDCRATE='SH') THEN ENTRYGRP=3;
IF (RCPGSCRT='2490' AND EXAMRATE NE '2490'
AND DMDCRATE NE 'SH') THEN ENTRYGRP=4;
IF (RCPGSCRT NE '2490' AND EXAMRATE='2490'
AND DMDCRATE='SH') THEN ENTRYGRP=5;
IF (RCPGSCRT NE '2490' AND EXAMRATE='2490'
AND DMDCRATE NE 'SH') THEN ENTRYGRP=6;
IF (RCPGSCRT NE '2490' AND EXAMRATE NE '2490'
AND DMDCRATE='SH') THEN ENTRYGRP=7;
*
| NEW VARIABLE "DEPNANTS" |
|-----;
IF MRTLDPND=10 THEN DEPNANTS=0;
IF MRTLDPND GT 10 THEN DEPNANTS=1;

GOODGUY=20;
IF LOSMNTHS < 48 THEN GOODGUY =10;
IF LOSMNTHS >= 48 AND RATED=1
AND ELIGREUP=1 THEN GOODGUY =30;
BADGUY=30;
IF LOSMNTHS < 48 AND (ISC3 <=87 AND
ISC3>=60) THEN BADGUY =10;
IF LOSMNTHS < 48 AND TOTLAWOL > 0 THEN BADGUY =10;
IF LOSMNTHS < 48 AND TOTDESRT > 0 THEN BADGUY =10;
IF LOSMNTHS < 48 AND TOTMLTCN > 0 THEN BADGUY =10;
IF LOSMNTHS < 48 AND TOTCVLCN > 0 THEN BADGUY =10;
IF LOSMNTHS < 48 AND BADGUY=30 THEN BADGUY =20;

```



```

IF LCSMNTHS >= 48 AND TOTLDEMO > 0 THEN BADGUY =20;
IF LCSMNTHS >= 48 AND ELIGREUP = 0 THEN BADGUY =20;
LABEL
DEFNENTS=SINGLE, NO KIDS 0/OTHERS 1
CHYEC =CONVERTED NUMBER OF YEARS OF EDUCATION
NUHYEAY =NHRC FILE-- HIGHEST PAYGRADE ATTAINED
NUSCHCDE=ADVANCEMENT FILE--'A' SCHOOL COMPLETED
NUATTRIT=NHRC FILE-- ATTRITION CODES
NUNCIRC =NHRC --NOT RECOMMENDED FOR RE-ENLISTMENT
NDAYSE22=SCREENED NUMBER OF DAYS TO E-2
NDAYSE23=SCREENED NUMBER OF DAYS TO E-3
NDAYSE24=SCREENED NUMBER OF DAYS TO E-4
ELIGREUP=ELIGIBLE TO RE-ENLIST
ATTRITC2=DMDC-EASED STANDARD ATTRITION MEASURE
ATTRITC3=DMDC-BASED NEGATIVE ATTRITION MEASURE
PAYGRADE=DMDC-EASED HIGHEST PAY-GRADE ATTAINED
ACHVDE4 =DMDC & NHRC CONCORDANT E-4 ACHIEVED
RATED =ACCESSED & MOST RECENTLY NAVY--MADE E-4
ENTRYGRP=7 ENTRY GROUPS, NHRC/EXAMRATE/DMDCRATE;
IF ENTRYGRP NE 4;
    RANDNUM1=FCUND(2*UNIFORM(12354));
    IF RANDNUM1=0 THEN RANDNUM1=2;
IF BASD1YR <= 78 OR (BASD1YR = 78 AND BASD1MTH <= 9);
IF ENTRYGRP NE 4;
IF ISC1 > 16 OR ISC1 < 10;* MEDICAL DISCHARGES;
IF ISC2 > 16 OR ISC2 < 10;* MEDICAL DISCHARGES;
IF ISC3 > 16 OR ISC3 < 10;* MEDICAL DISCHARGES;
IF ISC1 > 33 OR ISC1 < 30;* DEATHS DISCHARGEES;
IF ISC2 > 33 OR ISC2 < 30;* DEATHS DISCHARGEES;
IF ISC3 > 33 OR ISC3 < 30;* DEATHS DISCHARGEES;
IF ISC1 > 42 OR ISC1 < 40;* OFFICER ENTRANTS;
IF ISC2 > 42 OR ISC2 < 40;* OFFICER ENTRANTS;
IF ISC3 > 42 OR ISC3 < 40;* OFFICER ENTRANTS;
IF SEX=1;* SELECTS ONLY MALES;
FFCC SORT;
BY RACE;
FFCC STEPWISE;
BY RACE;
MCDEL LOSMNTHS GOODGUY BADGUY= AFQTPCNT
AFQTGRPS ASVABGI ASVABNO ASVABAD ASVABWK
ASVAEAR ASVABSP ASVABMK ASVABEI ASVABMC ASVABGS
ASVABSI ASVABAI ASVABCM ASVABCA ASVABCE ASVABCC
ENTRYAGE CHYEC ENTRPAYG MRTSTAT1
SCREEN DEPNDNTS/STEPWISE;
TITLE STEPWISE SELECTION OF PREDICTORS
BY RACE SH SAMPLE;
//

```





## TABLE XXVIII

## Program Listing to Output &amp; Cross Validate

```

//NESBITTS JOB (2501,C171),'NESBITT ',CLASS=C
//*MAIN LINES=(25),ORG=NFGVM1.2501P
// EXEC SAS
//SAS.WORK DD SPACE=(CYL,(25,50)),
//          DISP=(NEW,DELETE,DELETE)
//FILEIN DD DISP=SHR,DSN=MSS.S2501.NRATESH
//FT31F001 DD UNIT=3330V,MSVGP=PUB4Z,
//          DISP=(NEW,CATLG),DSN=MSS.S2501.SHLMN,
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=3120)
//FT32F001 DD UNIT=3330V,MSVGP=PUB4Z,
//          DISP=(NEW,CATLG),DSN=MSS.S2501.SHLWH,
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=3120)
//FT33F001 DD UNIT=3330V,MSVGP=PUB4Z,
//          DISP=(NEW,CATLG),DSN=MSS.S2501.SHLBL,
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=3120)
//FT34F001 DD UNIT=3330V,MSVGP=PUB4Z,
//          DISP=(NEW,CATLG),DSN=MSS.S2501.SHLOT,
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=3120)
//SYSIN DD *
data;set filein.nratesh;
ONEYEAR=0;IF LCSMNTHS >= 12 THEN ONEYEAR=1;
TWOYEAR=0;IF LOSMNTHS >= 24 THEN TWOYEAR=1;
THRYEAR=0;IF LCSMNTHS >= 36 THEN THRYEAR=1;
FORYEAR=0;IF LOSMNTHS >= 48 THEN FORYEAR=1;
IF SEX=1;* SELECTS ONLY MALES;
DATA TRIALDAT; SET DATA1;
IF RACE>0;* SELECTS ALL RACES;
DATA DIFFRNTZ; SET TRIALDAT;
DATA DERIV8;SET DIFFRNTZ;IF RANDNUM1>1;
DATA VALID8;SET DIFFRNTZ;IF RANDNUM1=1;
PROC REG DATA=DERIV8 SIMPLE OUTEST=B01;LOSM1HAT:MODEL
  LCSMNTHS=ENTRYAGE ASVABGI ASVABAI ASVABCA
  SCREEN MRTSTAT1 ENTRPAYG ASVABGS ASVABAD
  ASVABCC ASVABMC ASVABAR AFQTGRPS DEPNDNTS/STB;
TITLE MODEL ALL SHS FCR TOTAL LOS SAMPLE ONE;
PRCC REG DATA=VALID8 SIMPLE OUTEST=B02;LOSM2HAT:MODEL
  LCSMNTHS=ENTRYAGE ASVABGI ASVABAI ASVABCA
  SCREEN MRTSTAT1 ENTRPAYG ASVABGS ASVABAD
  ASVABCC ASVABMC ASVABAR AFQTGRPS DEPNDNTS/STB;
TITLE MODEL ALL SHS FCR TOTAL LOS SAMPLE TWO;
PROC SCORE OUT=B01PRED TYPE=OLS SCORE=B01
DATA=VALID8 PREDICT; VAR ENTRYAGE ASVABGI ASVABAI
  ASVAECA SCREEN MRTSTAT1 ENTRPAYG ASVABGS ASVABAD
  ASVABCC ASVABMC ASVABAR AFQTGRPS DEPNDNTS;
PROC SCORE OUT=B02PRED TYPE=OLS SCORE=B02
DATA=DERIV8 PREDICT; VAR ENTRYAGE ASVABGI ASVABAI
  ASVAECA SCREEN MRTSTAT1 ENTRPAYG ASVABGS ASVABAD
  ASVABCC ASVABMC ASVABAR AFQTGRPS DEPNDNTS;
PROC CORR DATA=B01PRED;VAR
  LOSMNTHS LOSM1HAT;
TITLE ALL SHS FIRST VALIDITY COEFFICIENT;
PRCC CORR DATA=B02PRED;VAR
  LOSMNTHS LOSM2HAT;
TITLE ALL SHS SECOND VALIDITY COEFFICIENT;
PRCC SCORE OUT=ALLPRED TYPE=OLS SCORE=B01
DATA=DIFFRNTZ PREDICT; VAR ENTRYAGE ASVABGI ASVABAI
  ASVAECA SCREEN MRTSTAT1 ENTRPAYG ASVABGS ASVABAD
  ASVABCC ASVABMC ASVABAR AFQTGRPS DEPNDNTS;
PROC SCORE OUT=TWOPRED TYPE=OLS SCORE=B02
DATA=allpred PREDICT; VAR ENTRYAGE ASVABGI ASVABAI
  ASVAECA SCREEN MRTSTAT1 ENTRPAYG ASVABGS ASVABAD
  ASVABCC ASVABMC ASVABAR AFQTGRPS DEPNDNTS;
DATA TABLE;SET TWOPRED;
PREDICTOR=(LOSM1HAT+LOSM2HAT)/2;

```





```

PRCC SORT; BY PRDICTOR;
TITLE SORTING BY PRDICTOR FOR ALL SH MEN;
DATA STORE;SET TABLE;FILE FT31F001;
PUT (FORYEAR PRDICTOR THRYEAR RACE) (10.7);
DATA TRIALDAT; SET DATA1;
IF RACE=1;* SELECTS WHITES SHS;
DATA DIFFRNTZ; SET TRIALDAT;
DATA DERIV8;SET DIFFRNTZ;IF RANDNUM1>1;
DATA VALID8;SET DIFFRNTZ;IF RANDNUM1=1;
PRCC REG DATA=DERIV8 SIMPLE OUTEST=B01;LOSM1HAT:MODEL
LCSMNTHS=ENTRPAYG ASVABGI ASVABAI ASVABMC SCREEN
MRTSTAT1 AFQTGRPS DEPNDNTS/STB;
TITLE MODEL WHITE SHS FOR LOS SAMPLE ONE;
PROC REG DATA=VALID8 SIMPLE OUTEST=B02;LOSM2HAT:MODEL
LCSMNTHS=ENTRPAYG ASVABGI ASVABAI ASVABMC SCREEN
MRTSTAT1 AFQTGRPS DEPNDNTS/STB;
TITLE MODEL WHITE SHS FOR LOS SAMPLE TWO;
PROC SCORE OUT=B01PRED TYPE=OLS SCORE=B01
DATA=VALID8 PREDICT; VAR ENTRPAYG ASVABGI ASVABAI
ASVABMC SCREEN MRTSTAT1 AFQTGRPS DEPNDNTS;
PROC SCORE OUT=B02PRED TYPE=OLS SCORE=B02
DATA=DERIV8 PREDICT; VAR ENTRPAYG ASVABGI ASVABAI
ASVABMC SCREEN MRTSTAT1 AFQTGRPS DEPNDNTS;
PROC CORR DATA=B01PRED;VAR
LOSMNTHS LOSM1HAT;
TITLE WHITES FIRST VALIDITY COEFFICIENT;
PRCC CORR DATA=B02PRED;VAR
LOSMNTHS LOSM2HAT;
TITLE WHITES SECOND VALIDITY COEFFICIENT;
PROC SCORE OUT=ALLPRED TYPE=OLS SCORE=B01
DATA=DIFFRNTZ PREDICT; VAR ENTRPAYG ASVABGI ASVABAI
ASVABMC SCREEN MRTSTAT1 AFQTGRPS DEPNDNTS;
PRCC SCORE OUT=TWOPRED TYPE=OLS SCORE=B02
DATA=ALLPRED PREDICT; VAR ENTRPAYG ASVABGI ASVABAI
ASVABMC SCREEN MRTSTAT1 AFQTGRPS DEPNDNTS;
DATA TABLE;SET TWOPRED;
PRDICTOR=(LOSM1HAT+LOSM2HAT)/2;
PRCC SORT; BY PRDICTOR;
TITLE SORTING BY PRDICTOR FOR WHITE SH MEN;
DATA STORE;SET TABLE;FILE FT32F001;
PUT (FORYEAR PRDICTOR THRYEAR RACE) (10.7);
DATA TRIALDAT; SET DATA1;
IF RACE=2;* SELECTS BLACKS ;
DATA DIFFRNTZ; SET TRIALDAT;
DATA DERIV8;SET DIFFRNTZ;IF RANDNUM1>1;
DATA VALID8;SET DIFFRNTZ;IF RANDNUM1=1;
PRCC REG DATA=DERIV8 SIMPLE OUTEST=B01;LOSM1HAT:MODEL
LCSMNTHS=ASVABCA SCREEN MRTSTAT1 ASVABCC AFQTGRPS/STB;
TITLE MODEL SH ELACKS FOR LOS SAMPLE ONE;
PRCC REG DATA=VALID8 SIMPLE OUTEST=B02;LOSM2HAT:MODEL
LCSMNTHS=ASVABCA SCREEN MRTSTAT1 ASVABCC AFQTGRPS/STB;
TITLE MODEL SH ELACKS FOR LOS SAMPLE TWO;
PROC SCORE OUT=B01PRED TYPE=OLS SCORE=B01
DATA=VALID8 PREDICT; VAR ASVABCA SCREEN
MRTSTAT1 ASVABCC AFQTGRPS;
PROC SCORE OUT=B02PRED TYPE=OLS SCORE=B02
DATA=DERIV8 PREDICT; VAR ASVABCA SCREEN
MRTSTAT1 ASVABCC AFQTGRPS;
PROC CORR DATA=B01PRED;VAR
LOSMNTHS LOSM1HAT;
TITLE BLACKS FIRST VALIDITY COEFFICIENT;
PROC CORR DATA=B02PRED;VAR
LOSMNTHS LOSM2HAT;
TITLE BLACKS SECOND VALIDITY COEFFICIENT;
PRCC SCORE OUT=ALLPRED TYPE=OLS SCORE=B01
DATA=DIFFRNTZ PREDICT; VAR ASVABCA SCREEN
MRTSTAT1 ASVABCC AFQTGRPS;
PROC SCORE OUT=TWOPRED TYPE=OLS SCORE=B02
DATA=ALLPRED PREDICT; VAR ASVABCA SCREEN

```



```

MRISTAT1 ASVABCC AFQTGRPS;
DATA TABLE;SET TWOPRED;
PRDICTOR=(LOSM1HAT+LOSM2HAT)/2;
PRCC SORT; BY PRDICTOR;
TITLE SORTING BY PRDICTOR FOR BLACK SH MEN;
DATA STORE;SET TABLE;FILE FT33F001;
PUT (FORYEAR PRDICTOR THRYEAR RACE) (10.7);
DATA TRIALDAT; SET DATA1;
IF RACE=3;* SELECTS OTHERS SHS;
DATA DIFFRNTZ; SET TRIALDAT;
DATA DERIV8;SET DIFFRNTZ;IF RANDNUM1>1;
DATA VALID8;SET DIFFRNTZ;IF RANDNUM1=1;
PROC REG DATA=DERIV8 SIMPLE OUTEST=B01;LOSM1HAT:MODEL
LCSMNTHS=ASVABGI ASVABAR ASVABGS ASVABMC ENTRYAGE
ASVABAD/ STE;
TITLE MODEL OTHERS SHS FOR LOS SAMPLE ONE;
PRCC REG DATA=VALID8 SIMPLE OUTEST=B01;LOSM2HAT:MODEL
LCSMNTHS=ASVABGI ASVABAR ASVABGS ASVABMC ENTRYAGE
ASVABAD/ STE;
TITLE MODEL OTHERS SHS FOR LOS SAMPLE TWO;
PRCC SCORE OUT=E01PRED TYPE=OLS SCORE=B01
DATA=VALID8 PREDICT ; VAR ASVABGI ASVABAR
ASVABGS ASVABMC ENTRYAGE ASVABAD;
PROC SCORE OUT=E02PRED TYPE=OLS SCORE=B02
DATA=DERIV8 PREDICT ; VAR ASVABGI ASVABAR
ASVABGS ASVABMC ENTRYAGE ASVABAD;
PRCC CORR DATA=E01PRED;VAR
LOSMNTHS LOSM1HAT;
TITLE OTHERS FIRST VALIDITY COEFFICIENT;
PRCC CORR DATA=E02PRED;VAR
LOSMNTHS LOSM2HAT;
TITLE OTHERS SECOND VALIDITY COEFFICIENT;
PRCC SCORE OUT=ALLPRED TYPE=OLS SCORE=B01
DATA=DIFFRNTZ PREDICT ; VAR ASVABGI ASVABAR
ASVABGS ASVABMC ENTRYAGE ASVABAD;
PRCC SCORE OUT=TWOPRED TYPE=OLS SCORE=B02
DATA=ALLPRED PREDICT ; VAR ASVABGI ASVABAR
ASVABGS ASVABMC ENTRYAGE ASVABAD;
DATA TABLE;SET TWOPRED;
PRDICTOR=(LOSM1HAT+LOSM2HAT)/2;
PRCC SORT; BY PRDICTOR;
TITLE SORTING BY PRDICTOR FOR OTHER SH MEN;
DATA STORE;SET TABLE;FILE FT34F001;
PUT (FORYEAR PRDICTOR THRYEAR RACE) (10.7);
/*

```



## TABLE XXIX

## Program Listing of FORTRAN Program for Cut-offs

```

      REAL PASS(4000), SCORE(3,4000), PASST(4000),      00 10
      * RETURN(3,4000), TOTRET(3,3), NPLOT(3),          00 20
      * SUCALL(3), RACE(4000), SRALL(3), UTILSF(2),      00 30
      * UTILSF(2), SCOMAX(3,2), TOTSC(3,3),             00 40
      * S(4000), R(4000), TMS(3), TMR(3)               00 50
      DATA UTILSF/-9244. 18488.0/,                     00 60
      DATA UTILSF/14495. 0, -14495./                   00 70
      SINGLE=3.                                          00 80
      D=55.0                                             00 90
      E=25.0                                             01 00
      DO 100 J=1, 3                                     01 10
      I=1                                                 01 20
      PASSA=0.0                                           01 30
      PASSB=0.0                                           01 40
      FAILA=0.0                                           01 50
      FAILB=0.0                                           01 60
      PASS(I)=0.0                                         01 70
      SCORE(J,I)=30.0                                     01 80
      RETURN(J,I)=0.0                                    01 90
      RETURN(J,I+1)=0.0                                  02 00
      RACE(I)=0.0                                         02 10
10  FORMAT(4F10.7)                                       02 20
20  I=I+1                                                 02 30
      READ(J,10,END=50) PASS(I), SCORE(J,I),           02 40
      * PASST(I), RACE(I)                                02 50
      PASSA=PASSA+PASS(I)                                02 60
      GO TO 20                                           02 70
50  CONTINUE                                             02 80
      NPLOT(J)=I-1                                       02 90
      GTOTAL=I-2                                         03 00
      FAILA=GTOTAL-PASSA                                 03 10
      X=PASSA*UTILSF(2)+PASSB*UTILSF(1)                 03 20
      X=X+FAILA*UTILSF(2)+FAILB*UTILSF(1)               03 30
      BASEUT=X/GTOTAL                                    03 40
      N=NPLOT(J)                                         03 50
      WRITE(6,109) J,GTOTAL,BASEUT,N                   03 60
109  FORMAT(I4,F10.3,F10.2,I8)                          03 70
      DO 40 I=2,N                                       03 80
      IF (PASS(I)) 31,31,32                             03 90
31  FAILB=FAILB+1                                       04 00
      FAILA=FAILA-1                                       04 10
      GO TO 33                                           04 20
32  PASSB=PASSB+1                                       04 30
      PASSA=PASSA-1                                       04 40
33  X=PASSA*UTILSF(2)+PASSB*UTILSF(1)                 04 50
      X=X+FAILA*UTILSF(2)+FAILB*UTILSF(1)               04 60
      X=X/GTOTAL                                         04 70
      IF (BASEUT.NE.0.0) GO TO 77                       04 80
      BASEUT=X                                           04 90
      IF (X.NE.0.) GO TO 77                             05 00
      RETURN(J,I+1)=0.                                  05 10
      GO TO 25                                           05 20
77  RETURN(J,I+1)=100*(X-BASEUT)/(BASEUT)              05 30
      IF (BASEUT.GT.0.0) GO TO 25                       05 40
      RETURN(J,I+1)=-RETURN(J,I+1)                     05 50
25  IF (I.EQ.2) GO TO 34                               05 60
      IF (RETURN(J,I+1).LT.SCOMAX(J,2)) GO TO 38        05 70
34  SCCMAX(J,2)=RETURN(J,I)                             05 80
      SCCMAX(J,1)=SCORE(J,I)                           05 90
      SRALL(J)=((PASSA+FAILA)/GTOTAL)*100              06 00
      IF (SRALL(J).GT.0.0) GO TO 53                     06 10
      SUCALL(J)=0.0                                      06 20
53  SUCALL(J)=((PASSA)/(PASSA+FAILA))*100              06 30
38  IF (RETURN(J,I).GT.-20.0) GO TO 40                 06 40

```





	RETURN (J,I) = -20.0	0650
40	CONTINUE	0660
	TOTSC (J,1) = SCOMAX (J,1)	0670
	TOTSC (J,2) = SCOMAX (J,1)	0680
	TOTSC (J,3) = D	0690
	TOTRET (J,1) = -20.0	0700
	TOTRET (J,2) = SCOMAX (J,2)	0710
	TOTRET (J,3) = E	0720
	E = E - 4.5	0730
100	CONTINUE	0740
	CALL TEK618	0750
	CALL BLOWUP (1.5)	0760
	CALL MX1ALF ('STANDARD', '/' )	0770
	CALL MX2ALF ('L/CSTD', '+') )	0780
	CALL YTICKS (5)	0790
	CALL XTICKS (5)	0800
	CALL PAGE (7.5, 6.0)	0810
	CALL AREA2D (6.5, 4.3)	0820
	CALL XNAME ('C+UT- /O+FF ON /P+REDICTOR	0830
	* CALL YNAME ('P+ERCENTAGE /E+QUATION', 36)	0840
	* FROM /B+ASE /R+ATE', 39)	0850
	CALL HEADIN ('SH M+EN ON /LOS	0860
	* C+RITERION', 26, -1., 3)	0870
	CALL HEADIN ('R+ACE /S+PECIFIC	0880
	* /S+ELECTION', 28, -1., 3)	0890
	CALL HEADIN ('F+OR /A+LL /SH M+EN', 19, -1., 3)	0900
	CALL GRAF (30, 5, 70, -20, 10, 30)	0910
	DO 200 J=1, 3	0920
	N=NPL0T (J)	0930
	DO 150 I=1, N	0940
	S(I) = SCORE (J, I)	0950
	R(I) = RETURN (J, I)	0960
	IF (I.GT.3) GO TO 150	0970
	TMS(I) = TOTSC (J, I)	0980
	TMR(I) = TOTRET (J, I)	0990
150	CONTINUE	1000
	IF (J.EQ.1) GO TO 160	1010
	IF (J.EQ.2) GO TO 155	1020
	CALL DASH	1030
	GO TO 160	1040
155	CALL DOT	1050
160	CALL CURVE (S, R, N, 0)	1060
	CALL CURVE (TMS, TMR, 3, 0)	1070
	CALL HEIGHT (.09)	1080
	CALL RLMESS ('M+AXIMUM /R+ETURN: ', 19,	1090
	* TOTSC (J, 3), TOTRET (J, 3) )	1100
	IF (J.EQ.1) GO TO 110	1110
	IF (J.EQ.2) GO TO 120	1120
	CALL RLMESS ('O+THERS', 7, 'ABUT', 'ABUT')	1130
	GO TO 130	1140
120	CALL RLMESS ('B+LACKS', 7, 'ABUT', 'ABUT')	1150
	GO TO 130	1160
110	CALL RLMESS ('W+HITES', 7, 'ABUT', 'ABUT')	1170
130	CALL RLREAL (SCOMAX (J, 1), 2,	1180
	TOTSC (J, 3) + 2., TOTRET (J, 3) - 2.)	1190
	CALL RLMESS ('', 1, 'ABUT', 'ABUT')	1200
	CALL RLREAL (SCOMAX (J, 2), 2, 'ABUT', 'ABUT')	1210
	CALL RLMESS ('%', 1, 'ABUT', 'ABUT')	1220
200	CONTINUE	1230
	D = 5.0	1240
	E = -5.0	1250
	CALL RLMESS ('SELECTION RATIOS:', 17, 55.0, D)	1260
	CALL RLMESS ('PERCENTAGE SUCCESSFUL:',	1270
	22, 55.0, E)	1280
	DO 300 J=1, 3	1290
	D = D - 2.0	1300
	E = E - 2.0	1310
	IF (J.EQ.1) GO TO 310	1320
		1330





	IF (J.EQ.2)	GO TO 320	1340
	CALL RLMESS	(' O+THER /G+ROUP :',18,55.0,D)	1350
	CALL REALNO	{SRALL(J),1,'ABUT','ABUT'}	1360
	CALL RLMESS	('%',1,'ABUT','ABUT')	1370
	CALL RLMESS	(' O+THER /G+ROUP :',18,55.0,E)	1380
	CALL REALNO	{SUCALL(J),1,'ABUT','ABUT'}	1390
	CALL RLMESS	('%',1,'ABUT','ABUT')	1400
	GO TO 300		1410
320	CALL RLMESS	(' B+LACK /G+ROUP :',18,55.0,D)	1420
	CALL REALNO	{SRALL(J),1,'ABUT','ABUT'}	1430
	CALL RLMESS	('%',1,'ABUT','ABUT')	1440
	CALL RLMESS	(' B+LACK /G+ROUP :',18,55.0,E)	1450
	CALL REALNO	{SUCALL(J),1,'ABUT','ABUT'}	1460
	CALL RLMESS	('%',1,'ABUT','ABUT')	1470
	GO TO 300		1480
310	CALL RLMESS	(' W+HITE /G+ROUP :',18,55.0,D)	1490
	CALL REALNO	{SRALL(J),1,'ABUT','ABUT'}	1500
	CALL RLMESS	('%',1,'ABUT','ABUT')	1510
	CALL RLMESS	(' W+HITE /G+ROUP :',18,55.0,E)	1520
	CALL REALNO	{SUCALL(J),1,'ABUT','ABUT'}	1530
	CALL RLMESS	('%',1,'ABUT','ABUT')	1540
300	CONTINUE		1550
	CALL ENDPL (C)		1560
	CALL DONEPL		1570
	STOP		1580
	END		1590



APPENDIX\_B  
STEPWISE REGRESSION RESULTS FOR RATINGS

This appendix gives the results of the stepwise regressions. They are presented in the form of rating specific tables. As these tables were constructed directly from computer output the variables all have the SAS names that were used in the analysis. Therefore, interested readers are directed to the relevant sections of the preceding SAS program listings to determine exactly which variables are listed. In all cases the variables and their coefficient signs correspond to the tables in the body of the thesis which lists the stepwise regression results.



TABLE XXX

## All SH Stepwise Regression Results

SH Whites on Length of Service						
	DF	SUM	OF	SQU	F	PROB>F
REGRESSION	8	16236.804			11.08	0.0001
ERROR	1297	237637.401				
TCTAL	1305	253874.205				
	B	VALUE	STD	E	F	PROB>F
INTERCEPT	26.670	1644				
AFQTGRPS	-0.920	9895	0.3761	5.99	0.0145	
ASVAEMC	-0.268	8282	0.1360	3.90	0.0484	
ASVAEAI	-0.170	3922	0.0978	3.03	0.0818	
ASVAECA	-0.155	5049	0.0917	2.87	0.0903	
ENTRPAVG	1.709	3734	0.8128	4.42	0.0357	
MRTSTAT1	5.667	77671	0.8366	45.89	0.0001	
SCREEN	0.248	5786	0.0607	16.73	0.0001	
DEPNDNTS	-3.883	2762	2.1708	3.20	0.0739	

SH Whites on GOODGUY						
	DF	SUM	OF	SQU	F	PROB>F
REGRESSION	4	3022.5064			12.22	0.0001
ERROR	1301	80462.1030				
TCTAL	1305	83484.6094				
	B	VALUE	STD	E	F	PROB>F
INTERCEPT	1.107	11196				
ASVAEMK	0.087	89585	0.0561	2.45	0.1174	
ASVAECE	-0.141	22207	0.0493	8.18	0.0043	
CHYEC	1.360	78242	0.2466	30.43	0.0001	
MRTSTAT1	1.094	21802	0.4740	5.33	0.0211	

SH Whites on BADGUY						
	DF	SUM	OF	SQU	F	PROB>F
REGRESSION	7	4135.7682			12.74	0.0001
ERROR	1298	60204.2011				
TCTAL	1305	64339.9693				
	B	VALUE	STD	E	F	PROB>F
INTERCEPT	-1.742	204431				
ASVAENO	0.039	38113	0.0225	3.04	0.0816	
ASVAEWK	-0.122	44891	0.0420	8.47	0.0037	
ASVAECE	-0.090	38137	0.0428	4.45	0.0352	
CHYEC	1.209	50502	0.2603	21.58	0.0001	
ENTRPAVG	0.904	72456	0.4131	4.80	0.0287	
MRTSTAT1	1.134	91198	0.4115	7.61	0.0059	
SCREEN	0.084	75720	0.0359	5.56	0.0186	

SH Blacks on Length of Service						
	DF	SUM	OF	SQU	F	PROB>F
REGRESSION	5	9203.0966			11.26	0.0001
ERROR	552	90267.1489				
TOTAL	557	99470.2455				
	B	VALUE	STD	E	F	PROB>F
INTERCEPT	32.737	6235				
AFQTGRPS	-1.956	1139	0.4563	18.37	0.0001	
ASVABCA	-0.428	0135	0.1625	6.93	0.0087	
ASVAECC	0.314	0531	0.1357	5.35	0.0211	
MRTSTAT1	6.246	9389	1.1323	30.43	0.0001	
SCREEN	0.215	5208	0.0872	6.10	0.0138	

SH Blacks on GOODGUY						
	DF	SUM	OF	SQU	F	PROB>F
REGRESSION	4	621.0247			3.34	0.0102
ERROR	553	25714.4591				
TCTAL	557	26335.4838				
	B	VALUE	STD	E	F	PROB>F
INTERCEPT	11.408	2688				
AFQTGRPS	-0.661	2232	0.2428	7.41	0.0067	



ASVAECC	0.0992502	0.0590	2.83	0.0931
MRTSTAT1	1.1435432	0.6035	3.59	0.0586
SCREEN	0.0855462	0.0460	3.45	0.0639

<u>SH Blacks on BADGUY</u>				
	DF	SUM OF	SQU	F
REGRESSION	4	900	0.1514	6.76
ERROR	553	1839	9.6692	
TCTAL	557	1929	9.8207	
	B	VALUE	STD E	F
INTERCEPT	11.19	98625		
ASVAEAR	-0.24	90178	0.0778	10.23
ASVAECC	-0.10	40409	0.0497	4.38
ENTRYAGE	-0.19	48975	0.1156	2.84
CHYEC	1.16	81247	0.3167	13.60

<u>SH Others on Length of Service</u>				
	DF	SUM OF	SQU	F
REGRESSION	6	863	6.5314	11.36
ERROR	149	1887	4.4685	
TCTAL	155	2751	11.0000	
	B	VALUE	STD E	F
INTERCEPT	54.99	34418		
ASVABGI	-1.17	11530	0.3280	12.74
ASVAEAD	-0.33	08399	0.1989	2.77
ASVAEAR	-0.87	98285	0.2952	8.88
ASVAEMC	-0.71	107025	0.3736	3.62
ASVAEGS	1.16	84002	0.3674	10.11
ENTRYAGE	0.61	42226	0.3009	4.17

<u>SH Others on GOODGUY</u>				
	DF	SUM OF	SQU	F
REGRESSION	5	1050	0.2840	5.95
ERROR	150	5293	3.3056	
TCTAL	155	6343	3.5897	
	B	VALUE	STD E	F
INTERCEPT	8.68	073217		
AFQTECNT	-0.09	486851	0.0286	10.93
ASVAEPI	-0.16	384685	0.1001	2.58
ASVAEAI	-0.28	815095	0.1548	3.46
ASVAECC	0.38	797354	0.1097	12.49
SCREEN	0.14	637842	0.0801	3.33

<u>SH Others on BADGUY</u>				
	DF	SUM OF	SQU	F
REGRESSION	5	644	4.5853	4.39
ERROR	150	3952	8.505	
TCTAL	155	4597	7.4358	
	B	VALUE	STD E	F
INTERCEPT	6.77	090112		
AFQTECNT	-0.16	194490	0.0584	7.67
AFQTEGRPS	1.31	562114	0.7261	3.28
ASVAEAI	-0.28	525384	0.1288	4.90
ASVAECC	0.23	515378	0.0952	6.09
CHYEC	0.98	156281	0.4234	5.37





TABLE XXXI

## All PN Stepwise Regression Results

PN White Men on Length of Service						
	DF	SUM OF	SQU	F	PROB>F	
REGRESSION	9	23114.535		14.78	0.0001	
ERROR	1216	211247.111				
TOTAL	1225	234361.647				
	B	VALUE	STD E	F	PROB>F	
INTERCEPT	30.6886800					
ASVAEWK	-0.3907675		0.0918	18.10	0.0001	
ASVAEAR	-0.2914101		0.1277	5.20	0.0227	
ASVABEI	-0.2812350		0.1048	7.19	0.0074	
ASVABSI	-0.2984347		0.1175	6.44	0.0113	
ASVAECE	0.1368159		0.0849	2.59	0.1076	
ENTRYAGE	0.3694307		0.1831	4.07	0.0439	
CHYEC	-1.0215411		0.4358	5.49	0.0193	
MRISTAT1	7.6648584		0.7969	92.49	0.0001	
SCREEN	0.2812599		0.0781	12.96	0.0003	

PN White Men on GOODGUY						
	DF	SUM OF	SQU	F	PROB>F	
REGRESSION	8	2013.1708		5.33	0.0001	
ERROR	1217	57483.8112				
TOTAL	1225	59496.9820				
	B	VALUE	STD E	F	PROB>F	
INTERCEPT	10.4760049					
ASVABWK	-0.1122275		0.0443	6.41	0.0115	
ASVAEAR	-0.2187153		0.0682	10.28	0.0014	
ASVABMC	0.0974479		0.0637	2.34	0.1267	
ASVABCE	0.1244157		0.0424	8.58	0.0035	
CHYEC	-0.3040941		0.1929	2.48	0.1154	
MRISTAT1	0.9357586		0.4190	4.99	0.0257	
SCREEN	0.1642128		0.0406	16.33	0.0001	
DEPNENTS	1.5133497		0.8221	3.39	0.0659	

PN White Men on BADGUY						
	DF	SUM OF	SQU	F	PROB>F	
REGRESSION	4	626.2016		5.70	0.0002	
ERROR	1221	33550.0625				
TOTAL	1225	34176.2642				
	B	VALUE	STD E	F	PROB>F	
INTERCEPT	12.9046054					
AFCTGFP	-0.5259052		0.1598	10.83	0.0010	
ASVABEI	0.0801835		0.0373	4.60	0.0321	
SCREEN	0.1092251		0.0268	16.54	0.0001	
DEPNENTS	1.1273538		0.6069	3.45	0.0635	

PN Black Men on Length of Service						
	DF	SUM OF	SQU	F	PROB>F	
REGRESSION	6	6750.8674		8.31	0.0001	
ERROR	276	37349.7756				
TOTAL	282	44100.6431				
	B	VALUE	STD E	F	PROB>F	
INTERCEPT	48.8556818					
AFCTPCNT	-0.1731397		0.0417	17.17	0.0001	
ASVABNO	-0.1314724		0.0864	2.31	0.1295	
ASVAECC	-0.3337261		0.1623	4.23	0.0408	
CHYEC	-2.4543496		0.5735	18.31	0.0001	
MRISTAT1	5.8937313		1.4492	16.54	0.0001	
SCREEN	0.4812862		0.1509	10.17	0.0016	

PN Black Men on GOODGUY						
	DF	SUM OF	SQU	F	PROB>F	
REGRESSION	7	950.4489		3.68	0.0009	
ERROR	275	10156.2648				
TOTAL	282	11106.7137				



	B VALUE	STD E	F	PROB>F
INTERCEPT	24.9538629			
ASVAEGI	0.3102658	0.1504	4.26	0.0401
ASVAENO	-0.1398792	0.0472	8.77	0.0033
ASVAEMK	0.1769179	0.1037	2.91	0.0894
ASVABEI	0.1726309	0.0956	3.26	0.0721
ASVAESI	-0.3085155	0.1207	6.53	0.0112
ASVABCE	-0.1521711	0.0810	3.52	0.0615
CHYEC	-0.5306986	0.2566	4.27	0.0396

<u>PN Black Men on BADGUY</u>				
	DF	SUM	OF	SQU
REGRESSION	4	390.1637		5.31
ERROR	278	5106.6559		
TCTAL	282	5496.8197		

	B VALUE	STD E	F	PROB>F
INTERCEPT	27.3597073			
ASVABSI	-0.2845607	0.0866	10.80	0.0011
ASVAEAI	0.2497785	0.0890	7.87	0.0054
ENTRYAGE	-0.3561344	0.1018	12.22	0.0006
ENTRPAVG	0.5638719	0.3534	2.54	0.1118

<u>PN Other Men on Length of Service</u>				
	DF	SUM	OF	SQU
REGRESSION	3	3425.1745		9.05
ERROR	87	10976.1221		
TCTAL	90	14401.2967		

	B VALUE	STD E	F	PROB>F
INTERCEPT	37.3172602			
ASVAEGI	-0.9104034	0.3173	8.23	0.0052
CHYEC	1.8625773	0.8067	5.33	0.0233
DEFNDNTS	-12.7447520	3.9740	10.28	0.0019

<u>PN Other Men on GOODGUY</u>				
	DF	SUM	OF	SQU
REGRESSION	5	774.4225		4.99
ERROR	85	2636.5664		
TOTAL	90	3410.9890		

	B VALUE	STD E	F	PROB>F
INTERCEPT	0.52074631			
AFOTPCNT	-0.12040574	0.0395	9.28	0.0031
ASVAEAR	0.30390695	0.2059	2.18	0.1437
ASVAECC	0.27792854	0.1166	5.63	0.0194
CHYEC	1.33872861	0.4117	10.57	0.0016
DEFNDNTS	-4.69898059	1.9942	5.55	0.0208

<u>PN Other Men on BADGUY</u>				
	DF	SUM	OF	SQU
REGRESSION	4	423.9178		5.34
ERROR	86	1705.7524		
TCTAL	90	2129.6703		

	B VALUE	STD E	F	PROB>F
INTERCEPT	5.84043938			
AFOTPCNT	-0.04974738	0.0219	5.16	0.0257
ASVAESI	0.37905240	0.1304	8.44	0.0047
CHYEC	1.08168182	0.3278	10.89	0.0014
DEFNDNTS	-3.35506552	1.5848	4.48	0.0372

<u>PN White Women on Length of Service</u>				
	DF	SUM	OF	SQU
REGRESSION	6	7047.9736		6.31
ERROR	472	87924.6777		
TCTAL	478	94972.6513		

	B VALUE	STD E	F	PROB>F
INTERCEPT	95.2187469			
ASVABAD	-0.3924025	0.1608	5.95	0.0151
ASVAEWK	-0.3429857	0.1734	3.91	0.0485
ASVAEAR	-0.4423221	0.2133	4.30	0.0387
ASVAECE	0.5541282	0.1689	10.75	0.0011



CHYEC	-2.7667462	0.8557	10.45	0.0013
ENTRPAVG	1.7744842	1.1070	2.57	0.1096

PN White Women on GOODGUY				
	DF	SUM	OF	SQU
REGRESSION	3	971.0785		5.62
ERROR	475	27338.7335		
TOTAL	478	28309.8121		
	B	VALUE	STD	E
INTERCEPT	29.1338691			F
ASVAEAD	-0.2337727	0.0893	6.85	0.0092
ASVAEWK	-0.1576776	0.0935	2.84	0.0924
ASVAEAR	-0.2607376	0.1169	4.97	0.0262

PN White Women on BADGUY				
	DF	SUM	OF	SQU
REGRESSION	5	576.7302		5.14
ERROR	473	10619.5119		
TOTAL	478	11196.2421		
	B	VALUE	STD	E
INTERCEPT	19.4431146			F
ASVABAD	-0.1212187	0.0556	4.75	0.0299
ASVAEAR	-0.2148259	0.0733	8.57	0.0036
ASVAESP	0.1078479	0.0632	2.91	0.0887
CHYEC	0.4943182	0.2339	4.47	0.0351
DEPNENTS	-2.6235293	0.9765	7.22	0.0075



TABLE XXXII

## All AT Stepwise Regression Results

<u>AT - White Men on Length of Service</u>					
	DF	SUM OF SQU	F	PROB>F	
REGRESSION	12	37330.665	29.55	0.0001	
ERROR	3327	350277.988			
TOTAL	3339	387608.653			
	B VALUE	STD E	F	PROB>F	
INTERCEPT	49.7303064				
AFQTECNT	0.0847810	0.0278	9.24	0.0024	
AFQIGRPS	-0.8119479	0.5030	2.60	0.1066	
ASVABNO	-0.0788686	0.0243	10.46	0.0012	
ASVAESP	-0.1110189	0.0670	2.74	0.0977	
ASVABMK	-0.1183909	0.0684	2.99	0.0839	
ASVAEGS	-0.1355446	0.0712	3.61	0.0574	
ASVAECA	-0.2048483	0.0586	12.19	0.0005	
ASVAECE	0.1205116	0.0453	7.07	0.0079	
CHYEC	-0.7428230	0.2858	6.75	0.0094	
ENTFPAYG	2.1286892	0.1946	119.62	0.0001	
MRTSTAT1	4.6121976	0.3735	152.47	0.0001	
SCREEN	0.0957458	0.0406	5.56	0.0185	

<u>AT - White Men on GOODGUY</u>					
	DF	SUM OF SQU	F	PROB>F	
REGRESSION	3	456.839	3.27	0.0202	
ERROR	3336	155283.609			
TOTAL	3339	155740.449			
	B VALUE	STD E	F	PROB>F	
INTERCEPT	13.8263146				
CHYEC	0.3864369	0.1663	5.40	0.0202	
ENTFPAYG	-0.1868022	0.1270	2.16	0.1415	
MRTSTAT1	0.5036740	0.2450	4.23	0.0399	

<u>AT - White Men on BADGUY</u>					
	DF	SUM OF SQU	F	PROB>F	
REGRESSION	6	4061.6007	32.17	0.0001	
ERROR	3333	70130.5848			
TOTAL	3339	74192.1856			
	B VALUE	STD E	F	PROB>F	
INTERCEPT	12.1536983				
AFQIGRPS	-0.3680884	0.1027	12.82	0.0003	
ENTRYAGE	0.0849608	0.0440	3.71	0.0541	
CHYEC	0.4063458	0.1381	8.65	0.0033	
ENTFPAYG	-0.9321898	0.0862	116.76	0.0001	
MRTSTAT1	-0.4857506	0.1669	8.47	0.0036	
SCREEN	0.0891893	0.0183	23.64	0.0001	

<u>AT - Black Men on Length of Service</u>					
	DF	SUM OF SQU	F	PROB>F	
REGRESSION	5	3777.9917	7.66	0.0001	
ERROR	167	16480.0660			
TOTAL	172	20258.0578			
	B VALUE	STD E	F	PROB>F	
INTERCEPT	76.0373893				
ASVAEGS	-0.6729970	0.2328	8.35	0.0044	
ASVAESI	-0.4349189	0.2312	3.54	0.0617	
ASVAECA	0.3428155	0.1777	3.72	0.0555	
CHYEC	-1.7461861	0.7264	5.78	0.0173	
MRTSTAT1	4.5120091	1.5433	8.55	0.0039	

<u>AT - Black Men on GOODGUY</u>					
	DF	SUM OF SQU	F	PROB>F	
REGRESSION	5	1239.3404	7.99	0.0001	
ERROR	167	5181.4687			
TOTAL	172	6420.8092			
	B VALUE	STD E	F	PROB>F	







INTERCEPT	47.2311662				
AFQTFCNT	0.2447246	0.0711	11.82	0.0007	
AFQTGRPS	-4.9159979	1.2330	15.89	0.0001	
ASVABGS	-0.2445383	0.1597	2.34	0.1277	
ASVAECA	0.1803334	0.1012	3.17	0.0768	
CHYEC	-1.0599272	0.4173	6.45	0.0120	

AT Black Men on BADGUY					
	DF	SUM	OF	SQU	F
REGRESSION	6	461.4027			5.82
ERRCR	166	2191.7764			
TOTAL	172	2653.1791			
	B VALUE	STD E		F	PROB>F
INTERCEPT	29.5616565				
AFQTFCNT	0.1124665	0.0452	6.17	0.0140	
AFQTGRPS	-3.0880771	0.7941	15.12	0.0001	
ASVAEAR	0.3320927	0.1154	8.28	0.0045	
ASVABMK	-0.1282669	0.0869	2.18	0.1421	
ASVAEAI	0.1147313	0.0618	3.44	0.0653	
ENTRPAVG	-0.6578062	0.3131	4.41	0.0372	

AT Other Men on Length of Service					
	DF	SUM	OF	SQU	F
REGRESSION	11	5054.3481			5.96
ERRCR	98	7557.6518			
TOTAL	109	12612.0000			
	B VALUE	STD E		F	PROB>F
INTERCEPT	-4.67799655				
ASVAEEI	0.60422952	0.2241	7.27	0.0083	
ASVABAI	-0.99876644	0.2561	15.21	0.0002	
ASVAECM	0.77440682	0.1924	16.20	0.0001	
ENTRYAGE	1.40536754	0.4478	9.85	0.0022	
SCREEN	0.71935965	0.1641	19.22	0.0001	

AT Other Men on GOODGUY					
	DF	SUM	OF	SQU	F
REGRESSION	10	2295.9445			6.94
ERRCR	99	3275.8736			
TOTAL	109	5571.8181			
	B VALUE	STD E		F	PROB>F
INTERCEPT	8.855750116				
AFQTFCNT	-0.18425571	0.0504	13.35	0.0004	
ASVAEAD	0.51458563	0.1369	14.11	0.0003	
ASVABWK	0.86805391	0.1648	27.72	0.0001	
ASVAEEI	-0.33035220	0.1353	5.96	0.0164	
SCREEN	0.34213980	0.1089	9.86	0.0022	

AT Other Men on BADGUY					
	DF	SUM	OF	SQU	F
REGRESSION	12	348.2633			6.55
ERRCR	97	1047.1911			
TOTAL	109	1895.4545			
	B VALUE	STD E		F	PROB>F
INTERCEPT	13.4256325				
ASVAEMK	0.3560198	0.1186	9.00	0.0034	
ASVABEI	-0.3764082	0.0825	20.77	0.0001	
ASVAEAI	-0.2365056	0.1077	4.81	0.0306	
SCREEN	0.1428342	0.0606	5.55	0.0205	

AT White Women on Length of Service					
	DF	SUM	OF	SQU	F
REGRESSION	4	3820.0507			5.05
ERRCR	235	44438.4450			
TOTAL	239	48258.4958			
	B VALUE	STD E		F	PROB>F
INTERCEPT	39.2507434				
ASVABEI	0.7791086	0.2424	10.33	0.0015	
ASVABCM	0.3521168	0.2423	2.11	0.1476	
ASVAECE	-0.5763499	0.2557	5.08	0.0252	



MRTSTAT1 -5.1232380 1.7929 8.17 0.0047

AT White Women on GOODGUY				
	DF	SUM	OF	SQU
REGRESSION	3	545.1452		
ERRCR	239	11038.3938		
TOTAL	242	11583.5390		
	B	VALUE	STD	E
INTERCEPT	12.9788322			
ASVAEEI	0.2686742	0.1179	5.19	0.0236
ASVAECM	0.2374158	0.1197	3.93	0.0485
ASVAECE	-0.3717212	0.1260	8.70	0.0035

AT White Women on BADGUY				
	DF	SUM	OF	SQU
REGRESSION	6	486.3025		
ERRCR	236	3667.6069		
TOTAL	242	4153.9094		
	B	VALUE	STD	E
INTERCEPT	16.5036012			
ASVABCE	-0.1729768	0.0651	7.04	0.0085
ASVAECC	0.1377274	0.0555	6.14	0.0139
ENTRYAGE	0.1883614	0.0896	4.42	0.0366
ENTFPAYG	-0.8121685	0.2866	8.03	0.0050
MRTSTAT1	1.3441319	0.5330	6.36	0.0123
DEFENDNTS	-3.3888684	1.0103	11.25	0.0009



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